

BUDGET INFORMATION - Construction Programs

NOTE: Certain Federal assistance programs require additional computations to arrive at the Federal share of project costs eligible for participation. If such is the case, you will be notified.

COST CLASSIFICATION	a. Total Cost	b. Costs Not Allowable for Participation	c. Total Allowable Costs (Columns a-b)
1. Administrative and legal expenses	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
2. Land, structures, rights-of-way, appraisals, etc.	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
3. Relocation expenses and payments	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
4. Architectural and engineering fees	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
5. Other architectural and engineering fees	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
6. Project inspection fees	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
7. Site work	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
8. Demolition and removal	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
9. Construction	\$ <input type="text" value="187,126,000.00"/>	\$ <input type="text"/>	\$ <input type="text" value="187,126,000.00"/>
10. Equipment	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
11. Miscellaneous	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
12. SUBTOTAL (sum of lines 1-11)	\$ <input type="text" value="187,126,000.00"/>	\$ <input type="text"/>	\$ <input type="text" value="187,126,000.00"/>
13. Contingencies	\$ <input type="text" value="18,713,000.00"/>	\$ <input type="text"/>	\$ <input type="text" value="18,713,000.00"/>
14. SUBTOTAL	\$ <input type="text" value="205,839,000.00"/>	\$ <input type="text"/>	\$ <input type="text" value="205,839,000.00"/>
15. Project (program) income	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
16. TOTAL PROJECT COSTS (subtract #15 from #14)	\$ <input type="text" value="205,839,000.00"/>	\$ <input type="text"/>	\$ <input type="text" value="205,839,000.00"/>
FEDERAL FUNDING			
17. Federal assistance requested, calculate as follows: (Consult Federal agency for Federal percentage share.) Enter eligible costs from line 16c Multiply X <input type="text" value="41"/> % Enter the resulting Federal share.			\$ <input type="text" value="84,393,990.00"/>

This duplicate of a previously funded application is intended for reference only.

Application for Federal Assistance SF-424

* 1. Type of Submission:

- ☐ Preapplication
☒ Application
☐ Changed/Corrected Application

* 2. Type of Application:

- ☒ New
☐ Continuation
☐ Revision

* If Revision, select appropriate letter(s):

* Other (Specify):

* 3. Date Received:

05/23/2022

4. Applicant Identifier:

5a. Federal Entity Identifier:

5b. Federal Award Identifier:

State Use Only:

6. Date Received by State:

7. State Application Identifier:

8. APPLICANT INFORMATION:

* a. Legal Name:

Oklahoma Department of Transportation

* b. Employer/Taxpayer Identification Number (EIN/TIN):

73-6017987

* c. UEI:

P14MNT7JM37

d. Address:

* Street1:

200 NE 21st Street

Street2:

* City:

Oklahoma City

County/Parish:

Oklahoma

* State:

OK: Oklahoma

Province:

* Country:

USA: UNITED STATES

* Zip / Postal Code:

73105-3299

e. Organizational Unit:

Department Name:

Project Management Division

Division Name:

f. Name and contact information of person to be contacted on matters involving this application:

Prefix:

* First Name:

Daniel

Middle Name:

* Last Name:

Nguyen

Suffix:

Title:

Project Management Division Engineer

Organizational Affiliation:

Oklahoma Department of Transportation

* Telephone Number:

405-522-3618

Fax Number:

* Email:

dnnguyen@odot.org

This duplicate of a previously funded application is intended for reference only.

Application for Federal Assistance SF-424*** 9. Type of Applicant 1: Select Applicant Type:**

A: State Government

Type of Applicant 2: Select Applicant Type:

Type of Applicant 3: Select Applicant Type:

* Other (specify):

*** 10. Name of Federal Agency:**

69A345 Office of the Under Secretary for Policy

11. Catalog of Federal Domestic Assistance Number:

20.937

CFDA Title:

National Infrastructure Project Assistance (Mega Projects)

*** 12. Funding Opportunity Number:**

NIPA-22-MEGA-22

* Title:

Mega Grants

13. Competition Identification Number:

Title:

14. Areas Affected by Project (Cities, Counties, States, etc.):

Add Attachment

Delete Attachment

View Attachment

*** 15. Descriptive Title of Applicant's Project:**

ENHANCING SAFETY AND MOBILITY IN WEST TULSA: I-44 AND US-75 CORRIDOR IMPROVEMENTS

Attach supporting documents as specified in agency instructions.

Add Attachments

Delete Attachments

View Attachments

Application for Federal Assistance SF-424	
16. Congressional Districts Of:	
* a. Applicant	OK-005
* b. Program/Project	OK001
Attach an additional list of Program/Project Congressional Districts if needed.	
	<input type="button" value="Add Attachment"/> <input type="button" value="Delete Attachment"/> <input type="button" value="View Attachment"/>
17. Proposed Project:	
* a. Start Date:	03/01/2024
* b. End Date:	12/31/2026
18. Estimated Funding (\$):	
* a. Federal	164,671,000.00
* b. Applicant	41,168,000.00
* c. State	0.00
* d. Local	0.00
* e. Other	0.00
* f. Program Income	0.00
* g. TOTAL	205,839,000.00
* 19. Is Application Subject to Review By State Under Executive Order 12372 Process?	
<input checked="" type="checkbox"/> a. This application was made available to the State under the Executive Order 12372 Process for review on 05/23/2022 .	
<input type="checkbox"/> b. Program is subject to E.O. 12372 but has not been selected by the State for review.	
<input type="checkbox"/> c. Program is not covered by E.O. 12372.	
* 20. Is the Applicant Delinquent On Any Federal Debt? (If "Yes," provide explanation in attachment.)	
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
If "Yes", provide explanation and attach	
	<input type="button" value="Add Attachment"/> <input type="button" value="Delete Attachment"/> <input type="button" value="View Attachment"/>
21. *By signing this application, I certify (1) to the statements contained in the list of certifications** and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances** and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 218, Section 1001)	
<input checked="" type="checkbox"/> ** I AGREE	
** The list of certifications and assurances, or an internet site where you may obtain this list, is contained in the announcement or agency specific instructions.	
Authorized Representative:	
Prefix:	
* First Name:	Chelley
Middle Name:	
* Last Name:	Hilmes
Suffix:	
* Title:	Chief Financial Officer
* Telephone Number:	405-522-6817
Fax Number:	
* Email:	Chilmes@odot.org
* Signature of Authorized Representative:	Robert A Hackney
* Date Signed:	05/23/2022

ENHANCING SAFETY AND MOBILITY IN WEST TULSA: I-44 AND US-75 CORRIDOR IMPROVEMENTS

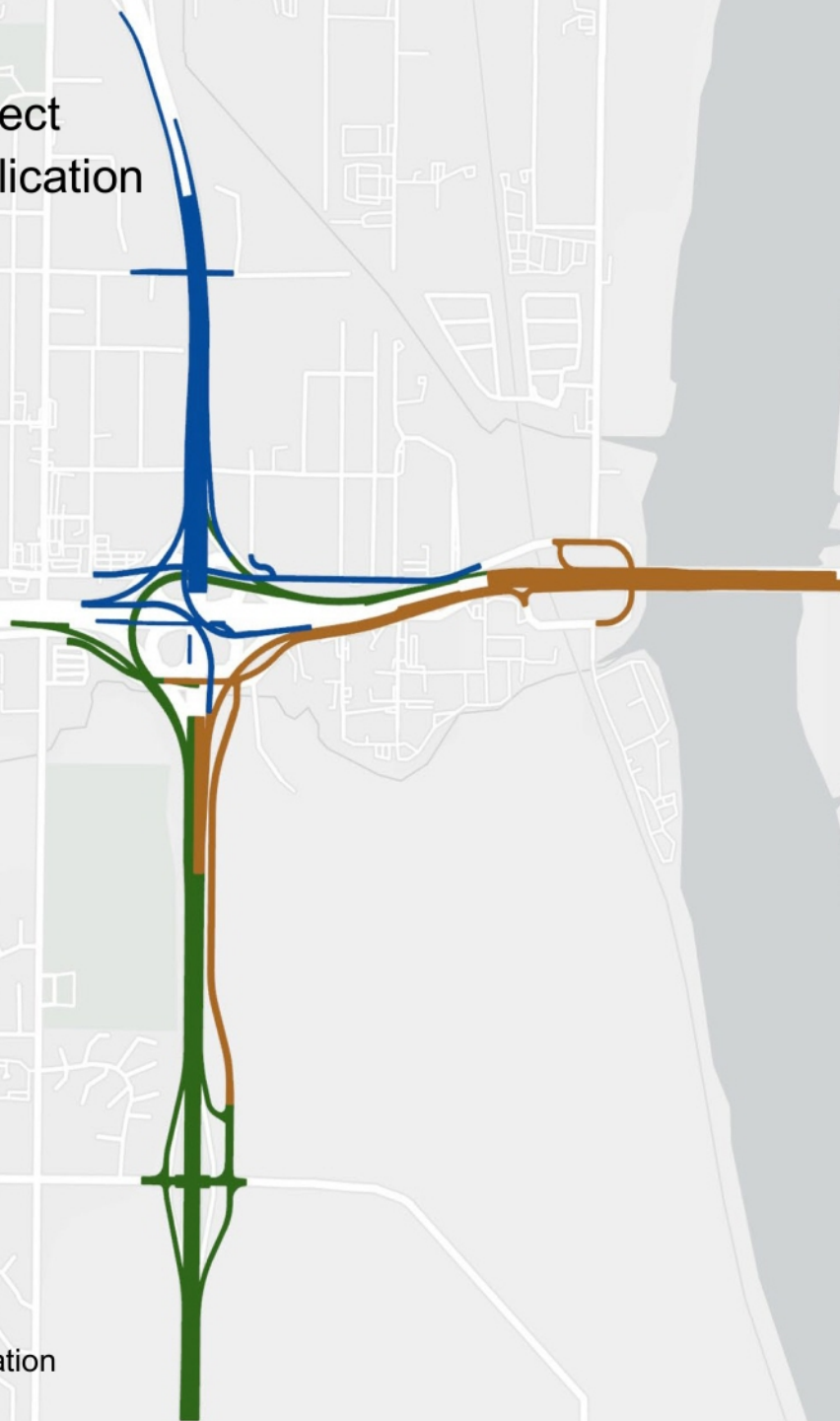
FY2022 Multimodal Project
Discretionary Grant Application

This duplicate of a previously funded application is intended for reference only.

Oklahoma Department of Transportation

MAY 2022

ODOT Contact: Daniel Nguyen
Project Management Division
(405) 522-3618 dnguyen@odot.org



FY2022 Multimodal Project Discretionary Grant Application

Enhancing Safety and Mobility in West Tulsa: I-44 & US-75 Corridor Improvements

Basic Project Information	
What is the project name?	Enhancing Safety and Mobility in West Tulsa: I-44 & US-75 Corridor Improvements
Who is the project sponsor?	Oklahoma Department of Transportation
Was an application for USDOT discretionary grant funding for this project submitted previously?	Yes (FY20 & FY21 INFRA, FY21 RAISE; all previously named: I-44 & US-75 Corridor Improvement Projects)
Projects will be evaluated for eligibility for all three programs unless the applicant opts-out of being evaluated for one or more of the grant programs:	<input type="checkbox"/> Opt-out of Mega? <input type="checkbox"/> Opt-out of INFRA? <input checked="" type="checkbox"/> Opt-out of Rural?
Project Costs	
MPDG request amount:	\$85,000,000
Estimated other Federal funding:	\$79,671,000
Other Federal funding:	
Other Federal funding from Federal Formula dollars:	\$79,671,000
Other Federal funding being requested from other USDOT grant opportunities:	\$0
Estimated non-Federal funding:	\$41,168,000
Future eligible project cost:	\$205,839,000
Previously incurred project costs:	\$129,460,000
Total project cost:	\$335,299,000
INFRA: Amount of future eligible costs by project type:	
1) A highway or bridge project on the National Highway Freight Network:	\$205,839,000
2) A highway or bridge project on the National Highway System:	\$205,839,000
4) A highway-railway grade crossing or grade separation project:	\$10,168,300
8) A highway, bridge, or freight project on the Nat. Multimodal Freight Network:	\$205,839,000
Mega: Amount of future eligible costs by project type: 8) A grouping, combination, or program of interrelated, connected, or dependent projects of any of the project types	\$205,839,000
Project Location	
State(s) in which project is located:	Oklahoma
INFRA: Small or large project:	Large
Urbanized Area in which project is located:	Tulsa, OK
Population of Urbanized Area:	655,479
Is the project located in Area of Persistent Poverty or Historically Disadvantaged Community? (Census Tracts)	Yes – (49 and 67.01)
Is the project located in Federal or USDOT designated areas?	Yes – Federal Opportunity Zone
Is the project currently programmed?	Yes – in STIP, MPO Transportation Plan, State Freight Plan and consistent with State LRTP

TABLE OF CONTENTS

PROJECT DESCRIPTION	1
Project Summary.....	1
Transportation Challenges Solved By This Project	3
Project History	4
Related Infrastructure Investments.....	5
PROJECT LOCATION	6
PROJECT PARTIES	7
GRANT FUNDS, SOURCES, & PROJECT FUNDING USES	8
PROJECT OUTCOME CRITERIA.....	9
Criterion #1: Safety	9
Criterion #2: State of Good Repair.....	11
Criterion #3: Economic Impacts, Freight Movement, & Jobs	12
Criterion #4: Climate Change, Resiliency, and the Environment.....	14
Criterion #5: Equity, Multimodal Options, and Quality of Life	16
Criterion #6: Innovation Areas.....	19
BENEFIT COST ANALYSIS	20
PROJECT READINESS & ENVIRONMENTAL RISK.....	21
Technical Feasibility	21
Project Schedule	21
Required Approvals.....	21
PROJECT REQUIREMENTS	24
APPENDIX A: BENEFIT COST ANALYSIS REPORT	i

This duplicate of a previously funded application is intended for reference only.

TABLES

Table 1: Previously Incurred Costs by Source and Use (\$1,000s) 8

Table 2: Future Eligible Costs by Source and Use (\$1,000s) 8

FIGURES

Figure 1: Project Map & Overview..... 2

Figure 2: Related Infrastructure Investments..... 6

Figure 3: Detailed Geographic Description of Project 7

Figure 4: Active Transportation Improvements Detail 18

PROJECT DESCRIPTION

The *Enhancing Safety and Mobility in West Tulsa: I-44 and US-75 Corridor Improvements Project* (The Project) application seeks \$85 million in 2022 MPDG funds. Completing this project will accelerate vital work to transform this aging and unsafe Interstate corridor. Its outcomes will include a safer, less congested link to the nation's economy for the fast-growing Tulsa region's businesses and to the region's many jobs, services, schools, and other opportunities, while reconnecting adjacent and historically disadvantaged communities.

PROJECT SUMMARY

Project Scope – Figure 1 shows The Project, which supports replacing and upgrading the most outdated, unsafe, and congested elements of Tulsa's I-44 corridor that carries almost 150,000 vehicles, including approximately 21,000 trucks, on a typical day.

The Project is centered around an interchange approximately 5 miles from downtown Tulsa where I-44 meets US-75. The 1950s-era 'cloverleaf' interchange has design elements like narrow shoulders, low bridge clearances, and short merges that give The Project area a crash rate almost double the statewide average for similar highways, resulting in frequent and sometimes deadly standing traffic backups. Furthermore, when the original highways were built, their design divided 2 West Tulsa communities that are Federally designated areas of persistent poverty.

The Project removes an interstate bottleneck with a crash rate twice that of similar facilities, reconnects local communities with vital amenities, and improves active transportation choices

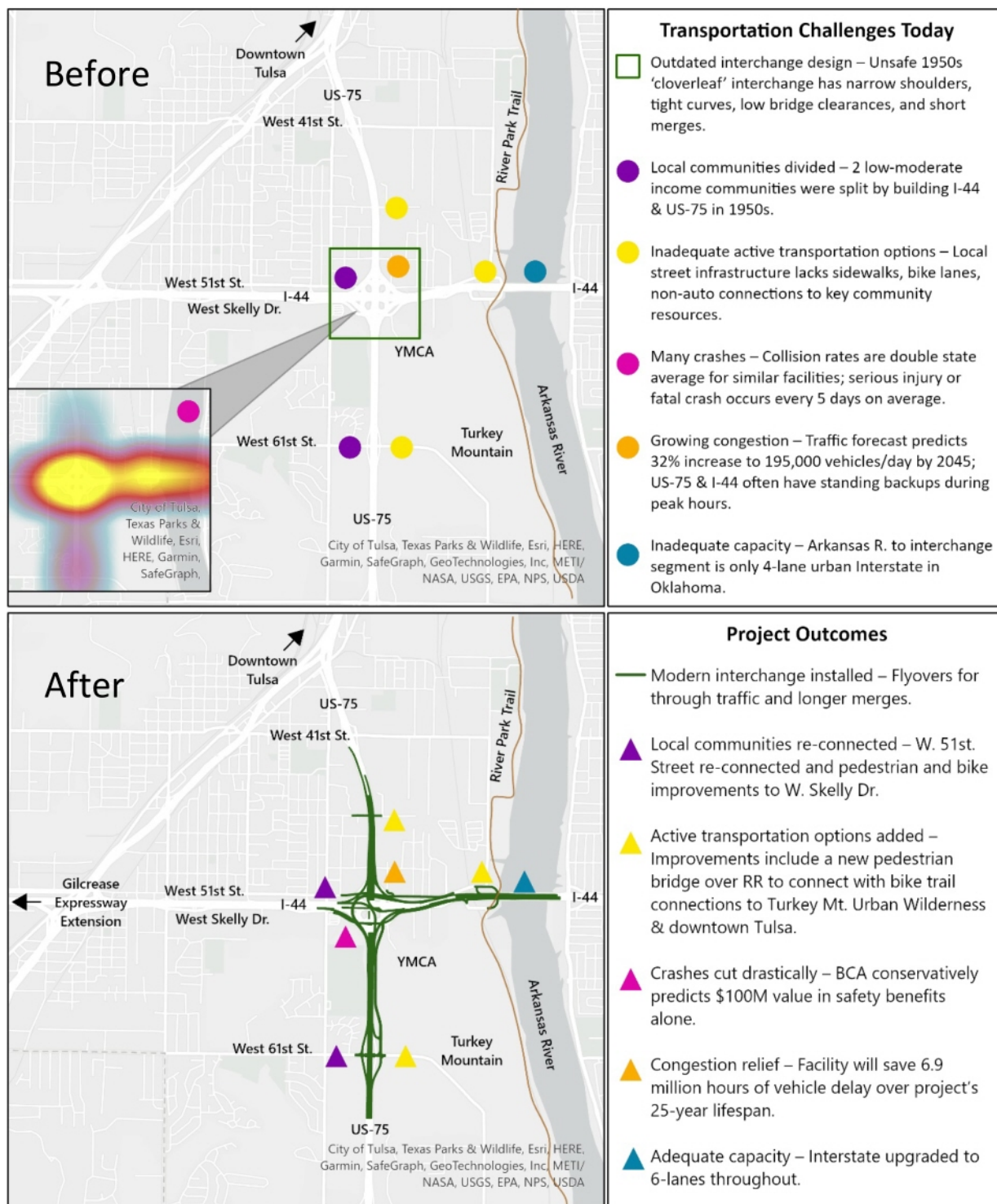
Among planned improvements are a new interchange with modern 'flyover' structures, wider shoulders, and more travel lanes. The Project also includes local street improvements to re-establish neighborhood connections and offer safer non-auto travel options in the communities that surround the interchange. Surrounding communities will now have convenient new links to resources like the 25-mile multi-use River Parks Trail with access to downtown Tulsa and Turkey Mt. Urban Wilderness.

Project Elements – Without an MPDG award, Oklahoma DOT (ODOT) would require years to gather the Federal and State funds needed to build this project. In preliminary engineering, it was split into 5 work phases, but this application proposes using MPDG funds to accelerate The Project by completing work phases 2, 3, and 5 together since work phase 1 has already moved to construction with support from a 2018 INFRA award. (See *Related Infrastructure* section.) This will ensure most of the much-needed safety, congestion, and community benefits are realized as soon as possible, rather than postponing them for decades.¹

Project Outcomes – This Eisenhower-era relic within Oklahoma's highway system cannot handle traffic volumes generated by the region's growing economy and forms a barrier for local communities. This project will make travel safer, bring one of Oklahoma's oldest Interstate assets into a state of good repair, reconnect communities, and deliver new active transportation options.

¹ Work phase 4 is behind other phases in design and therefore is not included as part of this application.

Figure 1: Project Map & Overview



TRANSPORTATION CHALLENGES SOLVED BY THIS PROJECT

Challenge:

Meeting Growing Travel Demand on I-44 & US-75

- Tulsa County has 2nd fastest growth in OK.
- Tulsa Co. added more population than 97% of counties in U.S. (2010-19).
- Daily traffic is forecasted to increase 32% resulting in 195,000 vehicles/day traveling through I-44/US-75 interchange by 2045.

Challenge:

Correcting I-44 Corridor's High Crash Rate

- Collision rates at the I-44/US-75 interchange almost double OK's average for similar highways.
- A serious injury/fatality crash occurs every 5 days on average (720 fatality & serious injury crashes 2010-19). Crashes will increase with more travel.
- Triggers for crashes include a 4-lane bottleneck segment of I-44 over Arkansas River & backups + merge conflicts at 'cloverleaf' interchange with outdated design.

Challenge:

Eliminating a Freight Bottleneck

- 21,000 trucks pass through the I-44/US-75 interchange daily.
- US-75 & I-44 are state 'critical freight corridors.'
- Local crossings of Arkansas River are limited.
- Outdated design causes congested bottleneck on National Highway Freight Network.

Challenge:

Getting Corridor Assets into State of Good-Repair

- Pavement rated in fair to poor condition.
- Low clearance bridges are often damaged by trucks.
- High maintenance costs.

Solutions:

- **Build Modern Interchange**
– Upgrade the hazardous system of collector and distributor roads, ramps and bridges between I-44 and US-75 to modern design standards.
- **Add Lane Capacity** – Provide a continuous 6-lane Interstate corridor through the City of Tulsa by widening 4-lane segment of I-44 from US-75 east over the Arkansas River bridge.
- **Install New Safety Features**
– Add safety improvements like safer bridge rail on all replaced bridges, barrier wall and impact attenuators on bridge approaches, pier protection, and safer barrier wall on bridge departures.
- **Widen Shoulders** – Add new median barrier protecting travelers in both directions and 12-foot inside and outside shoulders on mainline I-44 for greater safety.

Outcomes (Projected 2025-50):

- **Lives saved: 15**
- **Serious injuries avoided: 77**
- **Safety benefit value: \$100M**
- **Vehicle delay avoided: 6.9M hours**
- **Maint. cost savings: \$11.3M**

TRANSPORTATION CHALLENGES (CONTINUED)

<p>Challenge:</p> <p>Reconnecting Low-Income, Minority Communities Split by I-44 & US-75</p> <ul style="list-style-type: none">○ The Project is adjacent to minority, low-moderate income neighborhoods of Carbondale and Winnetka Heights.○ 1950s-era roads and ramps built to serve interchange severed street grid connections within the community.	<p>Solutions & Outcomes:</p> <ul style="list-style-type: none">○ Improved Local Street Connections, including restored connection of W. 51st St., under US-75 north of I-44 & that helps reconnect 2 majority low-moderate income communities.○ Local Street Sidewalk Improvements designed with either finished sidewalks or shelf spacing for future sidewalk installation, e.g., along Skelly Ave., 46th, 49th, and 61st. Streets.○ New 51st St. Pedestrian Bridge over the TSU Railroad will connect neighborhoods to the Tulsa River Parks Trail System, Zarrow Regional Library, and Turkey Mountain Urban Wilderness.
<p>Challenge:</p> <p>Adding Non-Motorized Travel Options</p> <ul style="list-style-type: none">○ Non-motorized mobility is greatly hindered by the auto-oriented design of the interchange’s connecting roads and ramps.○ Valuable resources, e.g., Tulsa River Parks multi-user trail network, public housing, Turkey Mountain Urban Wilderness, and YMCA, are inaccessible from local communities without a car.	

PROJECT HISTORY

Long Needed Safety and Congestion Relief – Nine fatal crashes occurred around the I-44/US-75 interchange over the last decade and more than 150 crashes occur per year (including more than 70 serious injury crashes). Furthermore, the facility lacks adequate design features for current traffic volumes, which causes considerable travel time delays. As a result, this project has been anticipated by Tulsans for a long time. In fact, ODOT and its partners began considering improvements to Tulsa’s I-44/US-75 corridor as early as 1999 when a Major Investment Study led ODOT to develop functional design plans and an initial Environmental Assessment (EA). The EA was approved by the Federal Highway Administration (FHWA) with a Finding of No Significant Impact (FONSI). By 2018, ODOT had completed a full preliminary engineering study for a project centered on the I-44/US-75 interchange. The preliminary engineering study broke final design and construction into 5 work phases due to their cost and complexity.

A Way to Reconnect Divided Communities – Since The Project was first conceived and particularly during the completion of the 2018 preliminary engineering study, ODOT and its local partners and community stakeholders have emphasized broadening the corridor project’s scope beyond replacing outdated roadway safety and capacity deficiencies. As a result, the project also features improvements in local street infrastructure that reflect priorities in Tulsa’s regional transportation plans and that will better connect local neighborhoods and improve local non-motorized travel options. (See *Criterion #5 Equity* section for more details.)

Previously Incurred Costs Show Depth of Oklahoma’s Investment – Tulsa and the State of Oklahoma are deeply invested in this application, which is an integral element of the State’s efforts to address transportation challenges along this corridor. ODOT has incurred \$129.5 million to support work to date in the corridor which includes \$35.0 million for environmental and engineering studies, Right of Way (ROW) acquisition, and utility relocation, and \$94.5 million in construction costs for work phase 1. (See **Table 1** for details.)

Past INFRA and RAISE Applications – Initial improvements to the I-44 corridor west of this application’s focus area are under construction today and are supported with funds from a successful 2018 INFRA award for work phase 1. In efforts to build on this progress, ODOT has previously submitted additional discretionary award applications (including fiscal year (FY) 2020 and FY 2021 INFRA and FY 2021 RAISE) for bundled work phases 2, 3, and 5. The applications received good ratings but ultimately were not selected by the U.S. Department of Transportation (USDOT). Nonetheless, pursuing FY 2022 INFRA and Mega awards for this project is a high priority for ODOT and its partners given the urgency of this project as part of a wider vision for the Tulsa region and its applicability to USDOT’s stated funding priorities.

Project Readiness is High – Design of work phases 2, 3, and 5 has advanced since the FY 2021 RAISE and INFRA applications were submitted and is now at the 75 percent level; ROW acquisition will be complete by the end of 2022; a public open house presenting remaining work phases was recently concluded; and NEPA documentation authorizing construction was approved by FHWA in early 2022.

RELATED INFRASTRUCTURE INVESTMENTS

This application is part of a wider vision for Tulsa’s transportation network that is shared by ODOT and its regional partners. Many complementary investments have been made in Tulsa transportation infrastructure that have direct ties to The Project including the Oklahoma Turnpike Authority’s Gilcrease Expressway Extension, which opens to traffic in Summer 2022, and phase 1 work on the I-44 corridor. Together these investments show ODOT’s commitment to delivering an I-44 corridor project that supports Tulsa’s wider transportation network, as described below.

Gilcrease Expressway Extension – In 2022, the Oklahoma Turnpike Authority will finish building a major extension to the Gilcrease Expressway as shown in **Figure 2**, which is part of Tulsa County’s long-term plan to complete an outer highway loop around Tulsa’s central business district. The new alignment will add a new crossing of the Arkansas River west of downtown and will therefore provide a much more direct connection between West Tulsa’s I-44 corridor and Tulsa’s western and northern suburbs. This economically valuable improvement in access is expected to add 10,000 trips a day to the already congested I-44 corridor. Many of these trips are expected to be commercial trucks, as the Gilcrease Expressway will serve industrial and refinery businesses located in west Tulsa, which makes timely completion of this application’s Project even more important.

Figure 2: Related Infrastructure Investments

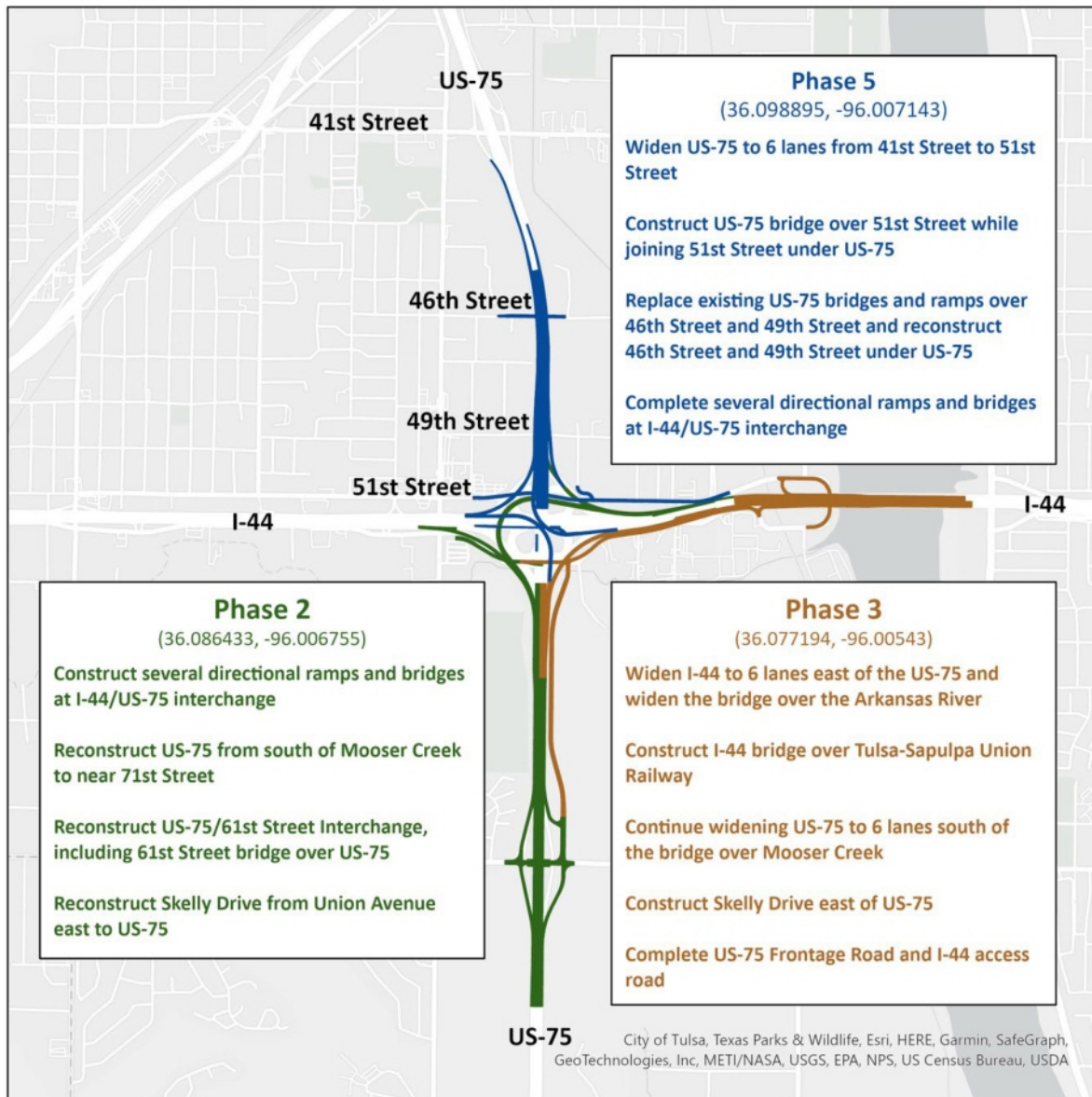


I-44 Corridor Work Phase 1 – Construction is already funded and underway for work phase 1 on the I-44 corridor, as shown in **Figure 2**, and will result in improvement of I-44 from its interchange with I-244 and the Gilcrease Expressway eastward to the I-44/US-75 interchange, which this application addresses. As such, phase 1 is considered by ODOT and its partners to be a vital element in the overall vision for upgrading Tulsa’s I-44 corridor. Some elements of work phase 1, including structure piers, will provide a foundation for elements of work phases 2, 3, and 5 covered in this application, however, the costs and benefits of work phase 1 are excluded from the BCA for this application since it is treated as a separate project for purposes of discretionary funding support.

PROJECT LOCATION

Location Description (See Maps – Figures 1, 2, & 3)	Urbanized Area	Federal Designations
<p>The Project is located at the I-44/US-75 interchange; boundaries as follows:</p> <ul style="list-style-type: none"> • West – I-44 at S. Union Ave. • East – I-44 at the east bank of the Arkansas River • North – US-75 at W. 41st St. • South – US-75 W. 61st St. 	Tulsa Urbanized Area (UA-88948)	<ul style="list-style-type: none"> ○ Area of Persistent Poverty ○ Historically Disadvantaged Community ○ Census Tracts 49 and 67.01 ○ Part of a Federal Opportunity Zone

Figure 3: Detailed Geographic Description of Project



PROJECT PARTIES

ODOT is the sponsor for The Project, on which it is coordinating with FHWA; the Indian Nations Council of Governments (INCOG), which serves as Tulsa's MPO; the Oklahoma Turnpike Authority; the City of Tulsa; and Tulsa County. ODOT and the City of Tulsa have worked closely throughout project development to coordinate on local street improvements, sidewalk and trail improvements, and drainage and utility design. Oklahoma's Congressional delegation, the City of Tulsa, INCOG, Tulsa Chamber of Commerce, and the Oklahoma Trucking Association have all provided support letters for The Project. All letters of support are available online at the [project website](#).

GRANT FUNDS, SOURCES, & PROJECT FUNDING USES

ODOT requests \$85 million in 2022 MPDG funds for The Project to cover 41 percent of future eligible project costs totaling \$205.8 million.

Previously Incurred Costs Summary – Table 1 summarizes \$129.5 million in previously incurred costs by funding source and use of funds.

Table 1: Previously Incurred Costs by Source and Use (\$1,000s)

Project Phase	State	Federal	Total
Environmental & Engineering	\$2,010	\$12,996	\$15,006
ROW & Utilities	\$15,000	\$5,000	\$20,000
Construction	\$27,087	\$67,367	\$94,454
TOTAL	\$44,097	\$85,363	\$129,460

Note: Previously incurred cost data includes construction costs for phase 1 work, which is being built with support in part from INFRA funds but includes overlapping engineering elements that provide an important foundation for this project. (See Related Transportation Infrastructure section for further details.)

Future Eligible Costs Summary – Table 2 summarizes \$205.8 million in future eligible costs by funding source and use of funds and in terms of the share of total costs borne by MPDG funds, other Federal funds, and State funds.

Table 2: Future Eligible Costs by Source and Use (\$1,000s)

Project Phase	State		MPDG		Other Federal		Total
Construction	\$37,425	20%	\$77,273	41%	\$72,428	39%	\$187,126
10% Contingency	\$3,743	20%	\$7,727	41%	\$7,243	39%	\$18,713
TOTAL	\$41,168	20%	\$85,000	41%	\$79,671	39%	\$205,839

Notes: Cost estimates based on engineer's estimated quantities & prices for similar projects built in Oklahoma. All costs are shown as year of expenditure dollars; this means total project costs (\$205.8M) are lower than the BCA's total project costs (\$207.9M), which USDOT guidance requires be expressed as 2020 dollars. Operations & maintenance costs will be covered 100 percent by State transportation funds. Contingency set at 10% to cover unexpected cost increases such as abnormally high inflation

Funding Commitments – ODOT's 8 Year Construction Work Plan (CWP) for FY 2022 to 2029 and Statewide Transportation Improvement Plan (STIP) for FFY 2022 to 2025 outlines ODOT's commitment to allocate future State transportation funds to this project. (PDF copies of the CWP and the STIP are available at the [project website](#).) ODOT's CWP and STIP show work phases 2 and 3 programmed to begin in 2023 and work phase 5 programmed to begin in 2024 but ODOT will accelerate these schedules to meet MPDG spending deadlines if this application is awarded. The non-Federal funds come from the Rebuilding Oklahoma Access and Driver Safety (ROADS) Fund and they have no limit or conditions to satisfy.

PROJECT OUTCOME CRITERIA

CRITERION #1: SAFETY

Tulsa's least functional Interstate highway element routinely suffers hazardous standing traffic back-ups due to outdated design features. This means people and businesses in the surrounding communities designated as areas of persistent poverty and as historically disadvantaged communities, as well as users from further afield whose daily trips rely on the I-44 corridor, are forced to make their journeys in congested conditions with a crash rate almost twice the statewide average for similar facilities.

This project will greatly improve safety for all users of Tulsa's I-44 corridor. By replacing the 'cloverleaf' ramp design and adding other safety-related engineering solutions like wider shoulders and median barriers, The Project will reduce crashes along the corridor by an estimated 45 percent based on the most applicable FHWA crash reduction factor in the agency's crash modification factors database.

Today's Safety Problems

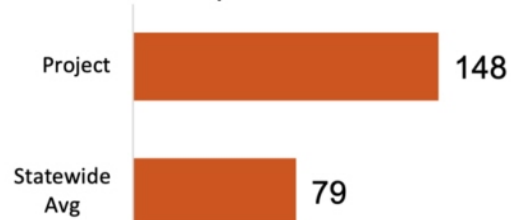
Outdated cloverleaf interchange design needs safety improvements. The current facility includes tight loop ramps, limited merge areas, and restricted lane capacity. The facility is the only 4-Lane urban interstate in Oklahoma.

Year Built:

1953

I-44/US-75 interchange crash rate is almost 2x higher than similar facilities statewide.

Crashes per 100M VMT



Fatality and/or serious injury crashes occur every 5 days at the I-44/US-75 interchange.

10 Year Collision Data 2010-19:

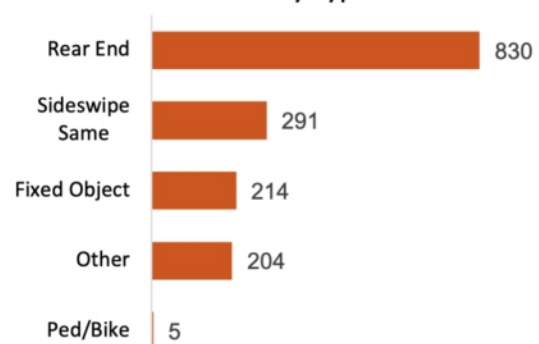
9 fatal crashes

720 serious injury crashes

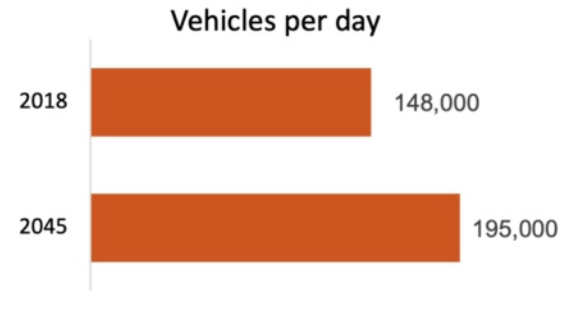
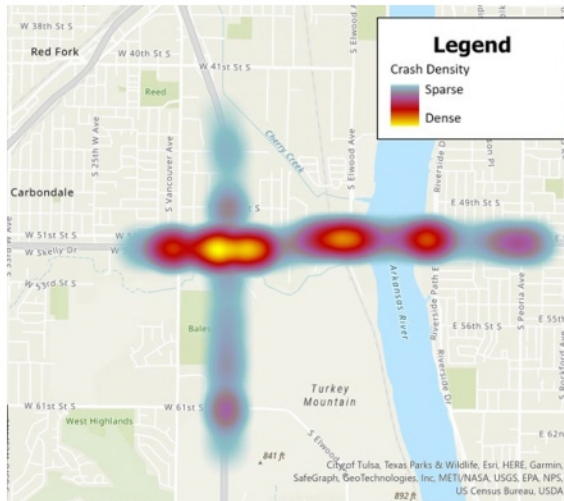
1,544 total crashes

Rear-end crashes due to stopped/slow traffic were most common from 2010-2019:

Crashes by Type



Significant travel growth at I-44/US-75 interchange is anticipated due to fast growth of the Tulsa region.



Project's Anticipated Safety Outcomes

- **Eliminate About 110 Collisions Annually by 2050** – The new, safer interchange and associated improvements like standard 12-foot shoulders and median barriers will eliminate major causes of traffic slow-downs and reduce the corridor’s crash rate by 45 percent, or about 110 collisions annually by 2050 (including 23 serious injury and fatality collisions a year) based on historical crash data analysis and application of FHWA crash modification factors.
- **Avoid 15 Fatalities and 77 Serious Injuries (over 25 Years) Valued at \$100 Million** – By eliminating collisions every year at or near the I-44/US-75 interchange, the number of fatalities and serious injuries will shrink by an estimated 15 fatalities and 77 serious injury accidents over the 25-year life of The Project. This is a conservative estimate, based on crash modification factors and was developed as part of The Project’s preliminary engineering study. The BCA estimates the monetary value of these expected safety benefits is \$100 million.
- **Safer Routes for Vulnerable Users** - By including active transportation upgrades and protections on local streets previously designed only for auto use, the risk of fatalities and serious injuries to bicyclists and pedestrians will be lowered by The Project. Improvements include, but are not limited to:
 - Sidewalks along W. 51st Street and 49th Street.
 - A new pedestrian bridge over railroad tracks to connect with Tulsa’s River Parks Trail.
 - Sidewalks along W. Skelly Avenue that provides a safe connection to existing sidewalks and community destinations including Turkey Mountain Urban Wilderness and the local YMCA (see Criterion #5 Equity).
 - Bike lanes and sidewalks on 61st Street.

CRITERION #2: STATE OF GOOD REPAIR

By reconstructing the I-44/US-75 interchange and several miles of associated roads, this project will transform the “fair to poor” condition rating of pavement on Tulsa’s I-44 corridor, while also eliminating its outdated 1950s design elements like narrow shoulder widths, low clearance bridges, and dangerous merge zones. The cost of replacing these assets will be offset in part by considerable savings in future operations and maintenance costs achieved by using longer-lasting materials and removing maintenance cost burdens associated with easily damaged low clearance bridges.

Today’s State of Good-Repair Condition

Corridor’s pavement is rated in fair to poor condition and has features like narrow shoulders inconsistent with designation as NHS and NHFN route carrying +/- 150,000 vehicles/day.



I-44 corridor includes several low clearance bridges that are at routine risk of damage by large vehicles.



Project’s Anticipated State of Good-Repair Outcomes

- **Improved Pavement Conditions** – The Project will reconstruct 3 miles of pavement, which will greatly enhance the condition of the corridor’s roadways. Furthermore, The Project’s new pavement will be designed to better withstand the almost one-third growth in traffic from 148,000 vehicles per day to 195,000 vehicles per day by 2045, which will result in maintenance cost savings.
- **Improved Bridge Conditions** – The Project will widen or replace 11 bridges, which will greatly enhance the condition of the corridor’s bridges and reduce maintenance costs associated with repairing damage to low clearance bridges.
- **Wider Shoulders** – The Project will provide consistent 12-foot width shoulders that meet modern Interstate design standards.
- **Lifecycle Cost Savings** – Compared to the ‘no build’ costs of maintaining the corridor’s roads and bridges, The Project is estimated to save \$11.3 million in maintenance costs (discounted at 7 percent) over the next 30 years. While lane miles that must be maintained will remain

similar, new bridge infrastructure will reduce costs for non-routine maintenance, and bridge repair and rehabilitation associated with bridge damage. ODOT projects that operations and maintenance (O&M) costs after The Project is complete will be \$8.6 million through 2050. By comparison, projected 'no-build' O&M costs to 2050 are \$43.3 million, including \$20.0 million for projected maintenance and rehabilitation costs, \$22.8 million in bridge rehabilitation costs, and \$0.5 million in projected bridge damage repair costs.

- **Support for Local Economy** – Replacing aging infrastructure sends strong signals to businesses that the region is doing well and can provide a good environment for business investment and expansion.
- **Consistency with statewide TAMP** – ODOT's Transportation Asset Management Plan (TAMP) was approved by FHWA in August 2019. This project is consistent with ODOT's dedication to asset management and its adherence to the TAMP, which will ensure adequate resources to maintain the I-44 corridor for the next 30 years.

CRITERION #3: ECONOMIC IMPACTS, FREIGHT MOVEMENT, & JOBS

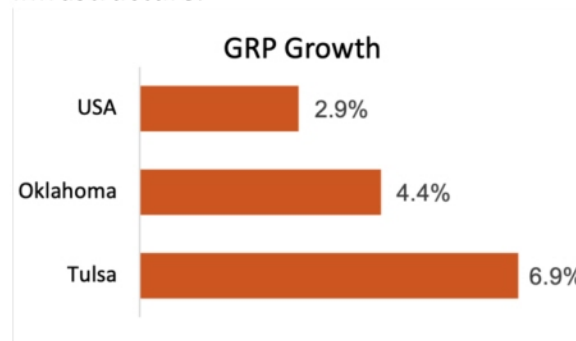
I-44 is part of the National Highway Freight Network (NHFN) and the Oklahoma Freight Network. US-75 and I-44 are listed in Oklahoma's Statewide Freight Plan as "critical urban freight corridors." Recurrent congestion and poor safety make the corridor a bottleneck that experiences travel delays and unreliable travel times, which affect supply chains and reduces access to job opportunities. By reducing crashes and travel delays and improving travel time reliability, this project will eliminate a freight bottleneck and expand access to jobs.

Today's Economic Impacts, Freight Movement & Jobs Situation

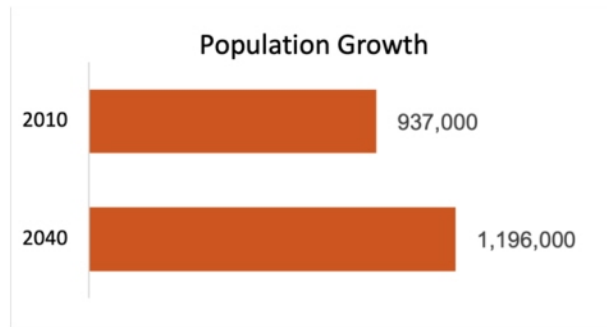
Frequent delays make the corridor a supply chain bottleneck. The corridor is on the National Highway Freight Network and trucks are 14% of traffic.



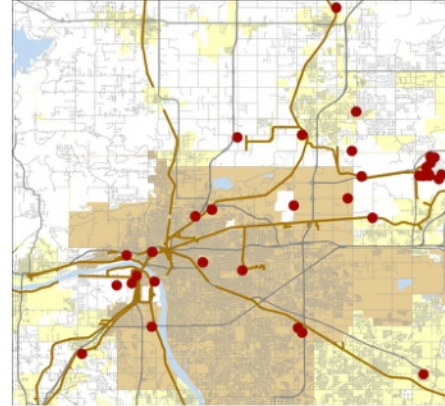
Tulsa Region's rapid Gross Real Product growth already overloads aging corridor infrastructure.



Tulsa's fast-growing population provides workforce growth that necessitates infrastructure improvements to maintain or improve access to jobs



Tulsa houses many major freight-generating businesses (red dots on map) including QuickTrip, XPO Logistics, & Amazon.



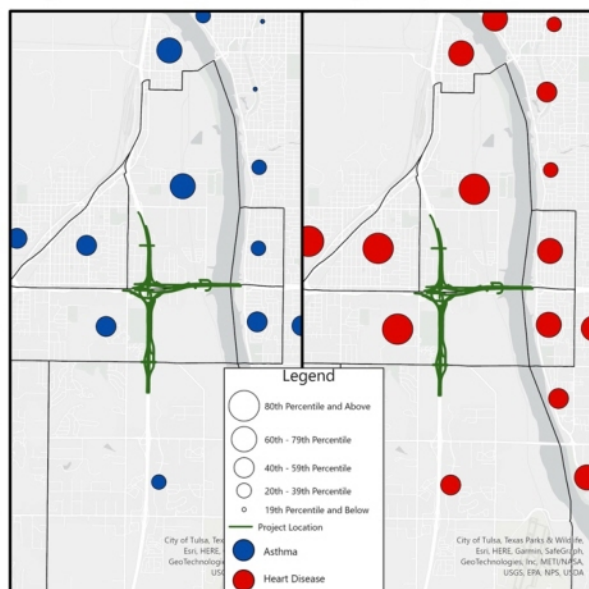
Project's Anticipated Economic Impacts, Freight Movement & Jobs Outcomes

- **6.9 Million Hours of Excess Vehicle Delay will be Eliminated Over the Life of Project.** Regional economic competitiveness benefits flow from travel time improvements and travel time reliability, which increase goods and people movement efficiency. By 2045, The Project is expected to save 1,193 hours of delay for passenger vehicles and freight each workday and total vehicle delay eliminated adds up to 6.9 million hours over The Project's lifespan valued at \$55.1 million.
- **Short Term Construction Hiring Boosted in Tulsa.** Based on running an *Impact Analysis for Planning* (IMPLAN) model, The Project is predicted to generate the equivalent of 1,468 short-term direct hires in the highway construction industry during the construction phase of The Project including good-paying construction jobs that on average pay 12 percent more than the statewide average annual wage (BLS, QCEW data, 2020) and create a total of 2,283 short-term jobs including indirect employment gains. Over 6 percent of all employees in Oklahoma are union members (BLS, Union Members in Oklahoma – 2021.)
- **Access to Major Intermodal Facility Will be Improved.** The Project improves access to and from the Port of Catoosa in Tulsa, which is a major hub in the McClellan-Kerr Arkansas River Navigation System that supports barge, rail, and truck freight modes.
- **Support for Local Community Investments and Recreational Activities** – The Project will support economic development and recreational investments in Tulsa including upgrades to the nearby Bales Baseball Park that will add 3 miles of trails for cycling and hiking funded in part by the city, the Burnstein Foundation, Bike Club Tulsa, and the Tulsa Housing Authority.

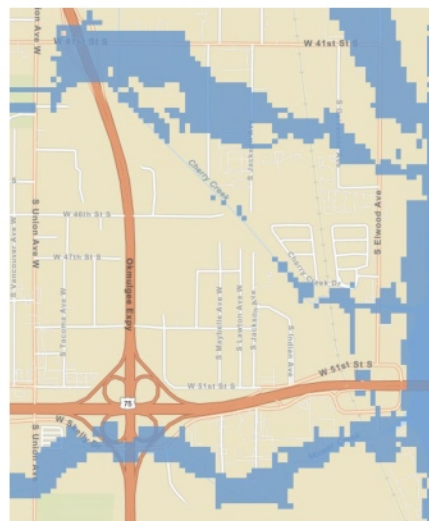
CRITERION #4: CLIMATE CHANGE, RESILIENCY, AND THE ENVIRONMENT

Today's Climate Change, Resiliency & Environment Context

EJSCREEN indicates significantly elevated levels of heart disease and asthma in neighborhoods surrounding the project area.



I-44 has experienced overtopping, and portions of The Project are located within the floodplains of Mooser and Cheery Creeks, including a regulatory floodway.



Hazardous waste sites within or adjacent to the project area:

22

Hazardous Waste Sites

13

Storage Tank Sites

3 are Leaking Underground Storage Tanks (LUST) that are now closed

The 600-acre Turkey Mountain Urban Wilderness is immediately adjacent to the project area. This wilderness area includes a thick canopy of native trees, Blackjack Oak, Hickory, and Redbud trees, and is a unique recreational treasure.



Local air quality pollutants and greenhouse gas emissions are elevated in the project area due to significant traffic congestion.

I-44 and US-75 are designated FHWA Alternative Fuel Corridors, and charging stations are located near The Project.

Project's Anticipated Climate Change, Resiliency & Environment Outcomes

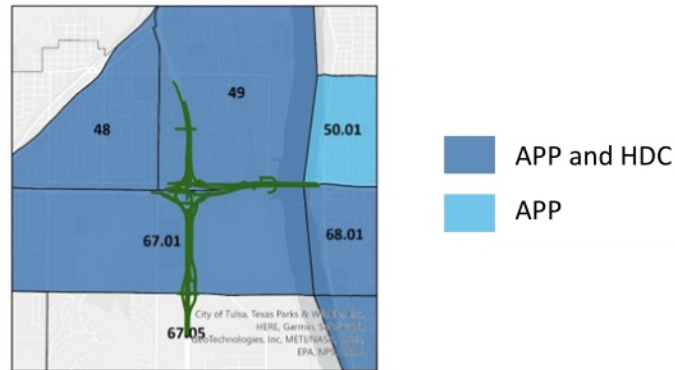
- **Local Air Quality and Public Health will be Improved and Will Benefit Adjacent Vulnerable Populations and the sensitive environmental assets of Turkey Mountain** – Based on EPA Motor Vehicle Emission Simulator (MOVES) model runs, air emission benefits were derived per hour of reduced travel delay. The Project results in improvements to local air quality in 2045 as follows:
 - Nitrous oxide (NO_x, a precursor to ground-level ozone) reductions of 177 tons.
 - Sulfur dioxide (SO₂) reductions of 0.92 tons.
 - Particulate matter 2.5 (PM_{2.5}) reductions of 6.35 tons.
- **Contaminated Hazardous Waste Sites will be Addressed** – ODOT has in place a well-defined and successful approach for identifying and including “areas of environmental concern” with construction plans so contractors can respond appropriately.
- **Greenhouse Gas Emissions will be Reduced** – Based on the U.S. Environmental Protection Agency’s MOVES model runs and the benefit cost analysis, The Project will result in a reduction of over 125,000 tons of carbon dioxide (CO₂) emissions because of congestion relief.
- **New Infrastructure will be More Resilient** – This will provide security for the adjacent low-income, minority neighborhoods that are often disproportionately affected by climate change impacts. The reconstruction of Skelly Drive and the new bridge structures over Mooser creek will be designed to accommodate 100-year storms, any flood storage removed by The Project will be replaced and stormwater runoff will be incorporated within Tulsa’s MS4 system to mitigate flooding risks, and all improvements will be consistent with Federal executive orders related to resilience and flood risk.
- **The Project Area is a Critical Location for Future Electric Vehicle Charging Infrastructure** – As key Alternative Fuel Corridors, the intersection of I-44 and US-75 is a critical location for the State’s EV Infrastructure Plan, which is under development.
- **Environmental Impacts Have Been Avoided** – NEPA studies have found no significant environmental impacts resulting from The Project and there are no significant public controversies on environmental grounds. The Project has been intentionally designed to have no direct negative effects on the adjacent Turkey Mountain Urban Wilderness Area.
- **The INCOG Transportation Improvement Program (TIP) Considers Land Use Implications and Promotes Low Carbon Travel** – Criteria include the following:
 - Does this project increase access in an area of environmental justice concern?
 - Does this project support efforts to improve air and water quality?
 - Does this project integrate multiple transportation modes?
 - Does this project utilize strategies that help improve reliability of travel times?

CRITERION #5: EQUITY, MULTIMODAL OPTIONS, AND QUALITY OF LIFE

Today's Equity, Multimodal Options & Quality of Life Context

Adjacent census tracts are designated as:

Areas of Persistent Poverty (APP) & Historically Disadvantaged Communities (HDC)



Neighborhoods surrounding The Project include:

A high minority population
concentration

31%

19%

at or below the Poverty Level

The inadequate design disproportionately impacts these populations. Many residents rely solely on the freeway system to gain access to the greater Tulsa metro and its largest employment centers. Many have no choice but to use the freeway and its outdated ramps, creating inequity in how the current safety and mobility challenges impact these citizens.

The interchange creates physical barriers for Neighborhoods, severing them from each other.



Active transportation facilities are non-existent or insufficient, further isolating residents, especially those that rely on walking and biking for mobility. Shown: 61st St. over US-75, with no pedestrian access.



Anticipated Outcomes for Equity, Multimodal Options & Quality of Life

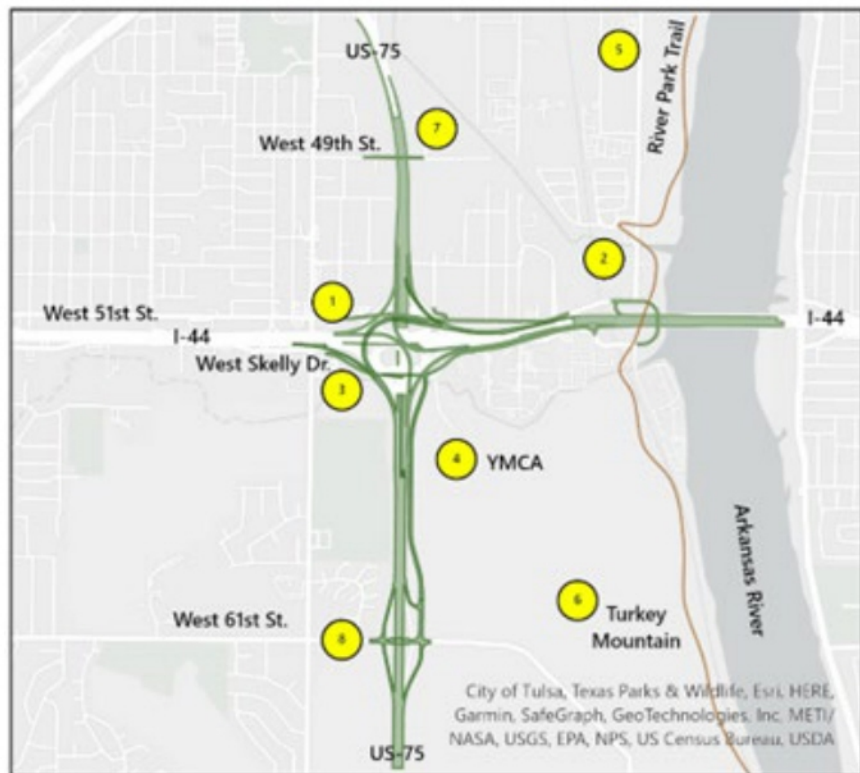
- **Community Assets Reconnected** – The Project will reconnect neighborhoods to local schools and amenities, including the new state-of-the-art YMCA, 26 miles of multi-use trails, the Turkey Mountain Urban Wilderness Area, the Zarrow Regional Library, and the numerous gathering areas, playgrounds, and art along the banks of the Arkansas River.
- **Multimodal Options Expanded** – The Project enhances pedestrian mobility in the area by filling in sidewalk gaps identified in the Tulsa Go Plan, the region's bicycle and pedestrian masterplan. The pedestrian and bicycle improvements will improve active, low-cost transportation access to jobs and vital community resources for these previously cut-off communities.
- **Improved Roadway Safety and Access to Jobs for Low Income/Minority Communities** – The Project will reduce congestion and improve safety on the transportation link that connects the local neighborhood to the most important job centers and services in Tulsa. The Project will provide improved freight access within a federal Opportunity Zone, providing an enhanced opportunity for economic development in this underserved area.
- **DBE Goals** – In preparation for letting, The Project will have a DBE goal set by ODOT based on the construction estimate and considering its length, complexities, required services, and availability of qualified DBE firms.
- **Minimal property impacts** - The development of 75 percent design plans indicates that Turkey Mountain, as well as minority and traditionally underserved neighborhoods, are not incorporated into any ROW takings necessary for The Project.

Figure 4 and the accompanying context below, provide specific details of how The Project will improve access to valuable community assets and improve multimodal options.

Targeted Public Engagement Tailored to the Community

ODOT has considered the effects of The Project on adjacent low-income and minority communities throughout its development and outreach was tailored to engage the local citizens. All 3 public meetings (held in 2017, 2020, and 2021) included targeted outreach to local minority churches, community centers, and the Tulsa Housing Authority which operates a low-income housing complex within the project area. Project information was sent to all addresses, including rental units, within the study area via hand-delivered flyers (in 2017) or by USPS Every Day Direct Mail (in 2020 and 2021 due to COVID-19). Handout materials at the first 2 public meetings were provided in Spanish, Chinese, and Vietnamese in addition to English.

Figure 4: Active Transportation Improvements Detail



1 51st St Connection restored, including a sidewalk – When the interchange was built, 51st was severed, creating a physical barrier within the community. The new interchange restores this connection and adds a new sidewalk.

2 New Pedestrian Bridge on 51st Street – Bridge over Tulsa-Sapulpa Union Railway will provide access to 26 miles of multi-use trails, removing a significant barrier for residents to access this important asset.

3 A New Sidewalk Corridor Along Skelly Avenue

Connects to an established sidewalk corridor west of the I-44/ US-75 interchange, east under the Mooser Creek Bridge to the US-75 access road.

4 Pedestrian and Bicycle Access to the New Herman and Kate Keiser YMCA – This facility, which was remodeled in 2021, was previously inaccessible to pedestrians and cyclists. The YMCA includes the area's largest outdoor pool, a renovated gymnasium, an array of group exercise classes/equipment, and gathering space around Lake Logan.



Opening Day of the new YMCA on June 5th, 2021. Pic by John Clanton of the Tulsa World

5 Safe Pedestrian Crossing on 49th St. – Under the new US-75 bridge, an offset shelf will be added for the City to install sidewalks.

6 Pedestrian and Bicycle Access to Turkey Mountain Urban Wilderness Area – This valuable community asset was previously inaccessible to local pedestrians and cyclists. The wilderness area includes over 300 acres of rugged parkland and offers dual trails for pedestrians and cyclists, 45 miles of hiking and mountain biking trails, and numerous recreational activities including fishing, rowing, kayaking, and disc golf.

7 Bicycle and Pedestrian Access Restored on 61st St. and Added Along the Northbound US-75 Frontage Road. Bike lanes and sidewalks will be added to 61st Street, which crosses over US-75 and a sidewalk will be installed along the US-75 frontage road from 61st to Skelly Avenue

CRITERION #6: INNOVATION AREAS

Technology

Innovation – ITS Deployment During Construction – During construction, ODOT will use Intelligent Transportation Systems (ITS) to ensure work zones on I-44 and US-75 are safe and to minimize travel delays for drivers. Radar, 2 cameras, 7 Dynamic Message Signs (DMS), and probe data will be used together to monitor travel speeds and congestion and support incident management. Once construction is complete, these ITS assets will remain in place and will be used by ODOT to monitor traffic and provide travel information to the public.

Innovation – Embedded Wireless Concrete Curing Strain Gauges – ODOT will require contractors to use embedded strain gauges in fresh concrete with wireless smartphone or remote logger connections to track the strength of concrete and support critical real-time decisions during concrete curing. This allows for removal of concrete forms and opening to traffic earlier than conventional time-constrained specifications.

Innovation – 3D Digital Project Plans – ODOT commits to providing 3D digital project plans as part of the contracting process. This technology will allow contractors to use state-of-the-art GPS-controlled automated equipment in the construction process, which reduces risk of human error in establishing grades and elevations while improving efficiency in earthmoving during the construction process and reducing the overall cost of construction.

Project Delivery

Innovation – Dedicated Resource Agency Liaisons – To streamline and expedite pre-construction environmental document review and permitting for The Project, ODOT took advantage of its established agency liaison positions at the U.S. Army Corps of Engineers (USACE), which accelerated and reviews and resulted in better environmental outcomes.

Innovation – “No Excuses Bonus” – For construction, ODOT will incentivize contractors to achieve early delivery of the whole project and stages open to traffic early by deploying no excuses bonuses, including a substantial completion incentive valued at 5 to 10 percent of the contract and smaller incentives for internal milestones tied to key project elements.

Innovation – Project Bundling and e-Contracting – Grant funding will save costs by allowing The Project to be bundled into a single construction contract of the kind envisioned in the FHWA’s *Every Day Counts* (EDC) Initiative, rather than staggering work over multiple project lettings as regular State and Federal funding becomes available. E-Construction methods will include mobile inspection and video monitoring and reporting of construction progress.

Financing

Innovation – Bills passed by the State Legislature in 2018 increase state revenue to ODOT by \$194.0 million per year, generated from the ownership or operation of a motor vehicle and reduce transfers of general-purpose state revenue to ODOT by the same amount. Increased state revenue improves ODOT’s ability to meet the needs of The Project.

BENEFIT COST ANALYSIS

The benefit cost ratio for The Project is estimated to be 1.22. A full copy of the benefit cost analysis (BCA) prepared for The Project is included in Appendix A.² Basic findings are presented below.

Key BCA Parameters

- 7% real discount rate (exception: 3% for CO₂ emissions)
- 2020 base discounting year
- 2020 dollars used to express all costs and benefits
- 25-year project life cycle
- Construction: 2024-2026; Operations commence in 2027
- No residual value assumed after 25 years of operation

Project Costs

Cost Type	No-Build (\$ Millions)	Build (\$ Millions)
Capital Costs	n/a	\$207.9
Operations & Maintenance	\$43.3	\$8.6

Note on operations & maintenance costs: Project will add no lane mileage compared to No-Build, so no incremental gain in routine lane-related maintenance costs is assumed. Under No-Build, ODOT estimates \$43.3M would be needed for combination of routine & non-routine maintenance, including maintenance and rehabilitation \$20M; bridge rehabilitation \$22.8M; bridge damage repair \$0.5M.

Major Benefits Included in BCA³

Crash Reductions – 60% of Total Benefit	<p>Method – Future crashes by severity forecasted using (1) historical ‘crashes by severity’ data for project area and (2) forecasted VMT and applying FHWA-derived crash modification factor of 55% tailored to The Project’s primary improvements to estimate crash numbers with or without The Project.</p> <p>Results – 15 lives saved and 77 serious injury crashes avoided over 25 years, which account for 60% of total benefits. These crash benefits are considered conservatively low.</p>
Travel Delay Savings – 33% of Total Benefit	<p>Method – Travel delay reductions estimated using VISSIM traffic simulation of The Project’s effects in 2045. Delay savings for years before and after 2045 are adjusted by a compound annual VMT growth factor of 1.5%.</p> <p>Results – In 2045, approximately 1,075 hours of delay will be saved by Project each workday AM/PM peak periods combined. Travel time savings account for 33 percent of total benefits.</p>

² Benefits and costs examined by the BCA are those associated with work phases 2, 3, & 5 depicted in Figure 3.

³ Other benefits included in BCA: 1) Air emissions. 2) Freight & shipper/logistics cost savings

BCA Results (\$ millions)

Discounted Initial Capital Costs	\$137.5
Discounted Life Cycle Cost Savings	-\$11.3
Facilities Residual Value Undiscounted	\$0.00
Discounted Present Value of Capital Costs	\$137.1
Travel delay cost savings (truck & auto)	\$55.1
Crash reduction benefits	\$100
Emissions reduction benefits (CO2 at 3% discount)	\$5.1
Emissions reduction benefits (all others at 7% discount)	\$2.6
Shipper/supply chain cost savings	\$5.1
Benefit Cost Ratio	1.22
Net Present Value (\$ millions 2020)	\$30.8

PROJECT READINESS & ENVIRONMENTAL RISK

TECHNICAL FEASIBILITY

ODOT is experienced in planning and delivering complex urban transportation infrastructure projects. For The Project, ODOT completed a comprehensive preliminary engineering (PE) study in September 2018 and final design work is 75 percent complete (see detailed plan sheets at the [project website](#)). The ROW process began in late 2020; ODOT appraisals are underway and expected to be complete by the end of 2022.

PROJECT SCHEDULE

All milestones for ensuring timely obligation of MPDG funds are complete or on track:



REQUIRED APPROVALS

Environmental Permits and Reviews NEPA

The NEPA clearance process for The Project is complete. Copies of environmental documents can be found at the [project website](#).

- **Environmental Documents** – An original EA completed in 2002 required a re-evaluation in the context of the 2018 PE study. Documented Categorical Exclusions for work phases 2, 3, and 5 were subsequently approved by FHWA in April 2022.
- **Supporting Environmental Studies** – All supporting studies including a wetland delineation, biological assessment, cultural resources survey, initial site assessment for hazardous waste, detailed noise study, and socioeconomic and environmental justice review are completed.
- **Required Resource Agency Consultations** – Consultation with State Historic Preservation Officer and U.S. Fish and Wildlife Services is completed. These agencies support ODOT’s findings of “no adverse effect” and “may affect, not likely to adversely affect.”
- **Clean Water Act 404 Permitting** – The Project crosses Mooser Creek and the Arkansas River, so Section 404 permits from the U.S. Army Corps of Engineers (USACE) will be required, which ODOT expects to be covered by Nationwide Permit 14 since similar coordination has already occurred under work phase 1. ODOT’s agency liaisons at the USACE will expedite permitting.
- **Public Involvement** – ODOT has conducted extensive public involvement for The Project:
 - **PE Study-related Engagement (2017)** – Initial public meetings presented the interchange concept as part of the original preliminary engineering study
 - **Virtual Public Open House (2021)** – ODOT hosted a virtual public open house for Work Packages 2, 3, 4, and 5 in mid-2021. (See open house website [here](#).) The public was invited to submit feedback and the website received 12,000 views in a 3-week period.
- **Access Justification Report** – ODOT’s Federally-required Access Justification Report (AJR) provided an operational and safety analysis of access changes to I-44 and was approved by FHWA in July 2020. The AJR and FHWA approval are included at the [project website](#).
- **State and Local Approvals** – The Project is programmed in ODOT’s 8 Year CWP, STIP, and INCOG’s TIP. The City of Tulsa has approved project design at all phases. As discussed in Criterion #5 section, The Project is supported in the community.

Federal Transportation Requirements Affecting State and Local Planning

- **INCOG Regional Transportation Plan (RTP)** – INCOG’s RTP, “Connected 2045,” includes The Project.
- **Statewide Transportation Improvement Program (STIP)** – ODOT’s STIP incorporates the first 4 years of ODOT’s 8-Year CWP. ROW and utility relocation phases are included for 2022 and construction is included in 2023 to 2025.
- **Oklahoma Long Range Transportation Plan (LRTP)** – The Project aligns with the long-range strategic policy and direction established in the ODOT 2020-2045 LRTP.
- **Oklahoma Transportation Asset Management Plan (TAMP)** – The Project is consistent with the goals set out in ODOT’s 2018-2027 TAMP which identifies strategies for maintaining and preserving Oklahoma’s transportation network.

- **Oklahoma Transportation Freight Plan** – The Project supports the mobility, connectivity, accessibility, and economic vitality goals of the 2018-2022 Oklahoma Freight Transportation Plan.

Assessment of Project Risks and Mitigation Strategies

- **Scheduling Delays** – Scheduling risks are low because project design work is 75 percent complete, while utility relocation and ROW acquisition are underway, and construction lettings for all work phases are set in ODOT's 8-year CWP.
- **Delay of Interrelated Projects** – While The Project depends on the timely completion of work phase 1, it is now under construction and on schedule to be open to traffic by 2023 so the risk of delay is low.
- **Inability to Secure ROW** – Failure to secure ROW can cause delay, but to minimize risk, ODOT's Right-of-Way Division performs early-stage analysis to predict ROW costs and includes a 20 percent contingency to account for unexpected costs. If landowners are unwilling to negotiate, ODOT will, as a last resort, use eminent domain to secure ROW for The Project.
- **Economic changes** – Economic issues can influence state funding, as the COVID-19 pandemic showed. Oklahoma, however, has made strides since 2006 to ensure steady and increased state transportation funding and has a record of timely delivery of major projects. Additionally, the funding commitment from ODOT for this project has no limit or conditions to satisfy.
- **Weather-related construction delays** – ODOT is seasoned in working closely with contractors to renegotiate project timelines in response to extreme weather, while still delivering The Project within projected time constraints.

PROJECT REQUIREMENTS

Will the project generate regional economic, mobility, or safety benefits?	BCA predicts 423,000 annual passenger hours of delay avoided, 15 lives saved, and 77 serious injury crashes avoided. In addition, The Project will provide active transportation mobility benefits, as described under criterion #5.
Will the project be cost effective?	Project has a benefit cost ratio of 1.22
Will the project contribute to 1 or more national goals identified in section 150?	<p>Safety: Project will reduce fatalities and serious injuries, as described in criterion #1.</p> <p>Infrastructure Conditions: Project will enhance infrastructure condition through capital improvements and asset management, as described in criterion #2.</p> <p>Congestion Reduction: Project will reduce congestion on the NHS.</p> <p>System Reliability: Project eases a significant bottleneck on the NHS.</p> <p>Freight Movement and Economic Vitality: Delivering greater travel time reliability will improve NHFN and support regional economic development.</p> <p>Environmental Sustainability: Project will reduce congestion-related emissions and provide community access to Turkey Mountain Urban Wilderness Area.</p> <p>Project Delivery Delays: Project has committed funding, is integrated into other plans, will use innovative project delivery practices and pre-construction is almost complete.</p>
Is the project based on results of preliminary engineering?	The PE Study was finished in Sept. 2018 including all topographic surveys, traffic studies, financial plans, and estimates of material types/quantities. Re-evaluation of 2002 Environmental Assessment is complete and required Categorical Exclusions have been signed by FHWA. Design plans are 75% complete. ROW acquisition is 65% complete.
Is the project expected to begin no later than 18 months after funds obligation?	Obligation of funds for letting construction will occur 8/31/2023, with letting scheduled for 9/29/23. Construction anticipated to start on 3/29/2024 and finish by 12/31/26.

APPENDIX A: BENEFIT COST ANALYSIS REPORT

This duplicate of a previously funded application is intended for reference only.

ENHANCING SAFETY AND MOBILITY IN WEST TULSA: I-44 AND US-75 CORRIDOR IMPROVEMENTS

Appendix Report: Project Benefit Cost Analysis

Oklahoma Department of Transportation

MAY 2022

Report Prepared by:
EBP US, Inc.

In Association with:
High Street Consulting Group, LLC (Prime Contractor)
Poe & Associates, Inc.

This duplicate of a previously funded application is intended for reference only.

Contents

- 1. Overview of Approach 1
- 2. Project Costs 1
 - 2.1. Capital Cost 2
 - 2.2. Operations and Maintenance Costs 2
- 3. Project Benefits..... 2
 - 3.1. Monetized Benefits included in the BCA 2
 - 3.2. Project Benefits Not Included in the BCA 10
- 4. BCA Results 10

1. Overview of Approach

A Benefit Cost Analysis (BCA) was conducted for work phases (WP) 2, 3, and 5 of the I-44/US-75 Interchange, a major part of the overall “Enhancing Safety and Mobility in West Tulsa: I-44 and US-75 Corridor Improvements” project (The Project). The BCA follows the most recent 2022 USDOT guidance for BCAs, which provides both methodological guidance and specific values for monetizing various types of benefits, such as hourly values of travel time, and the economic cost of vehicle crashes (including pedestrian-vehicle incidents), and air emissions. All values from that guidance are in 2020 dollars. All monetary values in the BCA, including costs, are expressed in constant 2020 dollars.

The following general parameters and assumptions have been used in conducting the BCA:

- A real discount rate of 7 percent is applied to all costs and benefits except for carbon emissions reductions, which are discounted at 3 percent.
- A project life cycle of 25 years is assumed, which represents a mid-point between a recommended 20-year horizon of analysis for rehab and replace projects, vs. 30 years for new right-of-way and facilities. The I-44 and US-75 Corridor Improvement Project comprises multiple individual elements reflecting a mix of old and rehabbed infrastructure.
- No residual value is assumed at the close of the 25 years of operation.
- Project construction is assumed to begin in 2024 and end in late 2026, with operation commencing in 2027. Some advanced right-of-way acquisition for interchange construction will occur in the years 2021 – 2024.
- All costs and benefits are in 2020 dollars.
- The year 2020 was used as the base year for discounting; that is, 2020 is considered year zero for discounting.

2. Project Costs

Major capital, maintenance, and bridge rehab and repair costs are summarized in **Table 1**. These exclude routine maintenance for items such as patching, snow or ice clearance, or other non-capital items.

Table 1: Build and No-Build Capital and Major Rehab Cost Summary in Millions of 2020\$

	No-build	Build
Total Maintenance	\$43.33	\$8.59
I-44/US-75 Maintenance & rehab	\$20.00	\$8.59
Bridge Rehab	\$22.83	
Bridge Damage Repair	\$0.51	
Capital Costs	n/a	\$207.9

Source: Oklahoma DOT design engineers

2.1. Capital Cost

The estimated capital cost of The Project is \$207.9 million in 2020 dollars (including contingency), and is broken down as follows:

- WP 2: \$75.85 million
- WP 3: \$60.80 million
- WP 5: \$71.21 million

2.2. Operations and Maintenance Costs

The Project will result in very little difference in lane mileage compared to the No-Build and as such, no incremental difference in routine lane-related maintenance costs has been assumed. However, as seen in the cost summary, there are significant differences in non-routine maintenance, bridge repair, and rehabilitation costs, and bridge damage costs. Under the No-Build, ODOT engineers estimate that \$43.33 million has been and will be spent for non-routine roadway and bridge maintenance, compared with \$8.6 million for the Build (i.e., with I-44 and US-75 Corridor Improvement Projects). Except for \$9.2 million already spent before today for the existing infrastructure, US-75, these represent significant future life cycle cost savings, which are included as cost offsets for BCA purposes. These prior 9.2 million expenditures are excluded from the BCA; however, if included, the benefit cost ratio is still above 1.0 and demonstrates ODOT's commitment to a state of good repair.

3. Project Benefits

3.1. Monetized Benefits included in the BCA

Four primary categories of benefit have been captured by the BCA: reduced motor vehicle crashes, travel delay savings, logistics (freight) cost savings, and emissions cost reductions. As noted above, life cycle and cost savings were moved to the denominator of the benefit cost ratio calculation, following USDOT BCA guidance. Furthermore, economic benefits such as enhanced productivity (over and above those embodied in travel time savings) are not included. However, the overall improvements in regional accessibility may generate additional productivity benefits, such as agglomeration benefits reflecting the improved ability of employers to access specialized labor.

Crash Reductions: Because much of The Project involves reconfiguring the complex network of US-75 and I-44 interchanges and approach lanes and roadways to the interchanges, a significant share of the anticipated benefits will be reduced vehicular collisions and improved pedestrian safety. To estimate these likely impacts, a detailed data list of all collisions that occurred throughout the I-44 and US-75 Corridor Improvement Projects limits between the years 2014 and 2018, by severity, was collected. Levels of severity were measured on a scale of one to five, including fatal crashes, injury crashes of three degrees of severity, and property-

damage-only crashes. These levels of severity are assumed to be roughly equivalent to KABCO scale measurements.

The following count of crashes over the five-year period (covering the full calendar years 2014 through 2018) was obtained from ODOT:

- 408 PDO (property damage only)
- 201 Injury Severity 2 (least severe)
- 134 Injury Severity 3
- 25 Injury Severity 4
- 5 Fatal (including 1 pedestrian fatality)

Table 2 summarizes the accident data, VMT data, and calculations leading to estimated accident reductions.

Table 2. Crash rate reduction calculations

Crash Reductions for Work Packages 2, 3, and 5								
Annual Crashes (2014-2018)	Total	Annual Average	Crashes/MVMT					
PDO	408	81.6	1.10					
Injury Severity 2	201	40.2	0.54					
Injury Severity 3	134	26.8	0.36					
Injury Severity 4	25	5.0	0.07					
Fatal	5	1.0	0.01					
VMT	2016 Actual	2040 Projected						
WP2	29,739,324	42,872,225						
WP3	28,454,999	38,123,064						
WP5	15,673,173	21,149,031						
Total	73,867,496	102,144,319						
Assumed Crash Reduction Factor								
45%								
Projected Annual Crashes (No Build)	2016	2025	2030	2035	2040	2045	2050	
PDO	81.60	92.15	98.59	105.48	112.85	120.73	129.17	
Injury Severity 2	40.20	45.40	48.57	51.96	55.59	59.48	63.63	
Injury Severity 3	26.80	30.26	32.38	34.64	37.06	39.65	42.42	
Injury Severity 4	5.00	5.65	6.04	6.46	6.91	7.40	7.91	
Fatal	1.00	1.13	1.21	1.29	1.38	1.48	1.58	
Projected Annual Crash Reduction (Build)	2016	2025	2030	2035	2040	2045	2050	
PDO	n/a	41.47	44.36	47.46	50.78	54.33	58.13	
Injury Severity 2	n/a	20.43	21.86	23.38	25.02	26.77	28.64	
Injury Severity 3	n/a	13.62	14.57	15.59	16.68	17.84	19.09	
Injury Severity 4	n/a	2.54	2.72	2.91	3.11	3.33	3.56	
Fatal	n/a	0.51	0.54	0.58	0.62	0.67	0.71	

Sources: Oklahoma DOT

Calculations: EBP

Based on these data, combined with annual vehicle miles traveled (VMT) measured across the project, crash rates were calculated (crashes per million VMT) and applied to ODOT's estimates of project-wide VMT in the future. A baseline of total anticipated crashes without the I-44 and US-75 Corridor Improvement Projects was then calculated for the entire project horizon of 25 years, through the year 2050. Next, the FHWA's Crash Modification Factor (CMF) database was consulted to obtain the most applicable Crash Reduction Factor (CRF). This search yielded a most relevant CMF of 55 percent (and thus a CRF of 45 percent). The selected CMF/CRF is obtained from research involving the safety effects of replacing cloverleaf interchanges with

directional lanes. The relevant CMF was then applied to the future stream of No-Build crashes (by category of severity) to obtain estimates of reduced annual crashes over the study period.

The Project will generate significant savings in the human costs of crashes. Over the 25 years, it is estimated that about 15 lives will be saved, and another 77 serious injury-crashes will be avoided.

Travel Delay Savings: ODOT provided an analysis of travel delay reductions based on the application of the VISSIM traffic simulation model to a future 2045 build year. The model simulated the effects of The Project on travel times. Based on estimates provided by ODOT, the BCA analysis assumes that 75 percent of the total travel delay reductions due to the entire I-44 and US-75 corridor improvements can be attributed to WPs 2, 3, and 5. Travel delay savings for years before 2045 were reduced based on the anticipated compound annual growth rates (CAGR) in VMT projected for the corridor of about 1.36 percent per year. For the years after 2045, the delay was correspondingly increased by the same CAGR. In 2030, approximately 933 hours of travel delay would be saved by The Project each workday, covering morning and evening peak periods combined. Travel delay savings increases to approximately 1,075 hours of delay per workday in 2045.

Table 3 presents the outputs of the VISSIM run.

Table 4 presents the computations to derive the annual travel delay for trucks (vehicle hours of delay) and passenger (passenger hours of delay). These savings were monetized utilizing the values of time prescribed in the 2022 USDOT BCA guidance.

Table 3. VISSIM travel delay outputs, Build and No-Build

AM Period	Delay (Seconds)			
	All	Auto	Single Axle Truck	Multi-Axle Truck
2045 AM - No Action	4,048,058	3,672,981	136,664	238,412
Ult Build AM 2045	2,458,430	2,295,220	75,521	87,690
PM Period	Delay (Seconds)			
	All	Auto	Single Axle Truck	Multi-Axle Truck
2045 PM - No Action	5,247,408	4,756,955	189,138	301,314
Ult Build PM 2045	1,108,531	999,481	43,956	65,094

Source: Garver Engineering and ODOT

Table 4. Travel delay calculations

Daily Vehicle Hours	2025	2030	2035	2040	2045	2050
Auto	814	871	933	999	1,070	1,145
Single Axle Truck	33	35	37	40	43	46
Multi-Axle Truck	61	66	70	75	81	86
Annual Vehicle Hours	2025	2030	2035	2040	2045	2050
Auto	203,386	217,799	233,233	249,761	267,460	286,149
Single Axle Truck	8,172	8,751	9,371	10,035	10,746	11,497
Multi-Axle Truck	15,325	16,411	17,574	18,820	20,153	21,561
Annual passenger hours saved	301,011	322,342	345,185	369,646	395,841	423,500

Source: EBP

Notes: Delay savings attributable to Work Packages 2,3, and 5 equal 75% of total project-wide VISSIM results. Delay savings for years other than 2045 based on CAGR for project VMT. Delay savings reduced for years prior to 2045 by compound growth factor of $(1 - \text{CAGR})$.

Air Emissions Reductions: No significant changes in VMT are anticipated as a result of The Project and therefore emissions savings were estimated based upon delay reductions for passenger cars and light trucks, medium-duty trucks, and heavy-duty trucks. The emissions factors were extracted from the TREDIS model, which were derived from a national-level analysis using the EPA's MOVES model. MOVES default model year distributions were used for each evaluation year, and default rural/urban restricted/unrestricted activity distributions were used. Running, starting, and extended idle (including crankcase) emissions processes were all included and aggregated. The emissions factors displayed in **Table 5** are scaled up by a factor of 10^6 for easier reading and are converted to the appropriate units in the accompanying benefit cost model.

The estimates in emissions reduction are based on per-ton valuations for the type of emissions as outlined in the 2022 US DOT BCA Guidance. Emissions include carbon dioxide (CO_2), nitrogen oxides (NO_x), sulfur oxide (SO_x), volatile organic compounds (VOC), and particulate matter (PM 2.5). The cost of carbon was discounted at 3% while all other emissions were discounted at 7%. VOCs were included as VOCs are a precursor to ozone which is recognized as having serious health impacts and monetized using prior USDOT valuation guidance and adjusted to 2020 dollars. If VOCs are removed, the benefit cost ratio remains at 1.2 as the aggregate impact of the VOC estimates are an undiscounted \$105,700 over the 25-year benefit period.

Based on air emission rates, combined with the travel delay reductions, annual emissions reductions were calculated and monetized. The Project will reduce CO_2 emissions by 5.023 tons a year through reduced congestion. (see **Table 6**).

Table 5. Air emissions rates per hour of travel delay in Tons multiplied by 10⁶.

	Co2	VOC	NOx	PM2.5	SOx
Car	12,884.90	4.96	7.79	0.37	0.08
Light Truck	40,664.22	6.83	64.33	2.99	0.34
Heavy Truck	76,946.75	19.88	241.78	7.17	0.68

Source: MOVES Emissions factors from TREDIS

Table 6. Aggregate Emissions Savings 2027-2051

	Total	Average Annual	Undiscounted \$
Co2	125,580.28	5,023.21	\$9,151,720
VOC	41.60	1.66	\$99,178
NOx	176.74	7.07	\$3,186,263
PM2.5	6.35	0.25	\$5,494,839
SOx	0.92	0.04	\$44,932
Total (excluding CO2)	n/a	n/a	\$8,825,212
Total (all emissions)			\$17,976,932

Source: EBP

Shipper and Logistics Cost Savings: Shipper and logistics cost savings are based on Freight Analysis Framework (FAF) Tulsa FAF region for 2020, truck travel delay savings, and data from the TREDIS-based Multimodal Benefit Cost Analysis (MBCA) tool. The FAF data were used to develop a commodity mix breakdown of the trucking data (see **Table 7**), and the commodity mixes were cross-referenced to Standard Classification of Transportation Goods (SCTG) data. These values are then applied to the truck travel delay savings to derive ton hours saved by commodity type and SCTG category. Ton hours saved are then multiplied by the hourly value of shipper delay for each commodity (hourly values are obtained from the TREDIS-based MBCA model). Costs are summed across all commodity types to derive the annual savings (see **Table 8**).

Table 7. Freight vehicle commodity mix breakout (Tulsa)

SCTG2	SCTG Description	Truck-Commodity Mix
1	Live animals/fish	0.3%
2	Cereal grains	2.7%
3	Other ag prods.	0.5%
4	Animal feed	0.6%
5	Meat/seafood	0.3%
6	Milled grain prods.	0.8%
7	Other foodstuffs	3.0%
8	Alcoholic beverages	0.3%
9	Tobacco prods.	0.0%
10	Building stone	0.0%
11	Natural sands	0.3%
12	Gravel	0.4%
13	Nonmetallic minerals	1.1%
14	Metallic ores	0.6%
15	Coal	0.0%
16	Crude petroleum	0.0%
17	Gasoline	2.2%
18	Fuel oils	1.4%
19	Coal-n.e.c.	50.0%
20	Basic chemicals	1.2%
21	Pharmaceuticals	0.0%
22	Fertilizers	7.8%
23	Chemical prods.	0.5%
24	Plastics/rubber	1.0%
25	Logs	0.0%
26	Wood prods.	1.4%
27	Newsprint/paper	0.3%
28	Paper articles	1.7%
29	Printed prods.	0.3%
30	Textiles/leather	0.2%
31	Nonmetal min. prods.	6.4%
32	Baseline metals	5.3%
33	Articles-Baseline metal	2.5%
34	Machinery	1.7%
35	Electronics	0.9%
36	Motorized vehicles	0.8%
37	Transport equip.	0.1%
38	Precision instruments	0.0%
39	Furniture	0.4%
40	Misc. mfg. prods.	0.8%
41	Waste/scrap	0.3%
43	Mixed freight	1.8%
99	Unknown	0.0%

Source: Tulsa FAF Region (2020)

Table 8. Calculation of shipper benefits for selected years

SCTG2	SCTG Description	2025	2030	2035	2040	2045	2050
1	Live animals/fish	\$2,938	\$3,146	\$3,369	\$3,608	\$3,863	\$4,133
2	Cereal grains	\$9,333	\$9,994	\$10,702	\$11,461	\$12,273	\$13,130
3	Other ag prods.	\$2,516	\$2,694	\$2,885	\$3,090	\$3,309	\$3,540
4	Animal feed	\$2,881	\$3,085	\$3,304	\$3,538	\$3,788	\$4,053
5	Meat/seafood	\$3,258	\$3,489	\$3,736	\$4,001	\$4,284	\$4,583
6	Milled grain prods.	\$4,618	\$4,945	\$5,296	\$5,671	\$6,073	\$6,497
7	Other foodstuffs	\$20,202	\$21,633	\$23,166	\$24,808	\$26,566	\$28,422
8	Alcoholic beverages	\$2,588	\$2,772	\$2,968	\$3,179	\$3,404	\$3,642
9	Tobacco prods.	\$27	\$29	\$31	\$33	\$36	\$38
10	Building stone	\$60	\$64	\$69	\$74	\$79	\$84
11	Natural sands	\$300	\$322	\$344	\$369	\$395	\$423
12	Gravel	\$391	\$419	\$449	\$480	\$515	\$550
13	Nonmetallic minerals	\$2,929	\$3,137	\$3,359	\$3,597	\$3,852	\$4,121
14	Metallic ores	\$766	\$820	\$878	\$941	\$1,007	\$1,078
15	Coal	\$20	\$22	\$23	\$25	\$26	\$28
16	Crude petroleum	\$158	\$169	\$181	\$194	\$208	\$222
17	Gasoline	\$10,126	\$10,844	\$11,612	\$12,435	\$13,317	\$14,247
18	Fuel oils	\$5,374	\$5,754	\$6,162	\$6,599	\$7,066	\$7,560
19	Coal-n.e.c.	\$208,345	\$223,109	\$238,919	\$255,850	\$273,981	\$293,126
20	Basic chemicals	\$6,996	\$7,491	\$8,022	\$8,591	\$9,199	\$9,842
21	Pharmaceuticals	\$849	\$910	\$974	\$1,043	\$1,117	\$1,195
22	Fertilizers	\$24,909	\$26,674	\$28,564	\$30,588	\$32,756	\$35,045
23	Chemical prods.	\$5,635	\$6,034	\$6,462	\$6,920	\$7,410	\$7,928
24	Plastics/rubber	\$10,753	\$11,515	\$12,331	\$13,205	\$14,141	\$15,129
25	Logs	\$139	\$149	\$159	\$171	\$183	\$196
26	Wood prods.	\$8,842	\$9,469	\$10,140	\$10,858	\$11,628	\$12,440
27	Newsprint/paper	\$2,725	\$2,919	\$3,125	\$3,347	\$3,584	\$3,835
28	Paper articles	\$14,654	\$15,692	\$16,804	\$17,995	\$19,270	\$20,617
29	Printed prods.	\$2,256	\$2,416	\$2,587	\$2,771	\$2,967	\$3,174
30	Textiles/leather	\$2,130	\$2,281	\$2,442	\$2,615	\$2,801	\$2,996
31	Nonmetal min. prods.	\$27,590	\$29,545	\$31,639	\$33,881	\$36,282	\$38,817
32	Baseline metals	\$36,646	\$39,243	\$42,024	\$45,002	\$48,191	\$51,559
33	Articles-Baseline metals	\$21,977	\$23,534	\$25,202	\$26,988	\$28,900	\$30,919
34	Machinery	\$44,806	\$47,982	\$51,382	\$55,023	\$58,922	\$63,039
35	Electronics	\$23,938	\$25,635	\$27,451	\$29,397	\$31,480	\$33,680
36	Motorized vehicles	\$21,360	\$22,873	\$24,494	\$26,230	\$28,089	\$30,052
37	Transport equip.	\$1,368	\$1,465	\$1,568	\$1,680	\$1,799	\$1,924
38	Precision instruments	\$1,387	\$1,485	\$1,590	\$1,703	\$1,824	\$1,951
39	Furniture	\$4,735	\$5,070	\$5,429	\$5,814	\$6,226	\$6,661
40	Misc. mfg. prods.	\$14,064	\$15,061	\$16,128	\$17,271	\$18,495	\$19,788
41	Waste/scrap	\$2,131	\$2,282	\$2,444	\$2,617	\$2,802	\$2,998
43	Mixed freight	\$11,675	\$12,503	\$13,389	\$14,337	\$15,353	\$16,426
99	Unknown	\$0	\$0	\$0	\$0	\$0	\$0
Total		\$568,395	\$608,674	\$651,808	\$697,998	\$747,461	\$799,690

Source: EBP

3.2. Project Benefits Not Included in the BCA

Due to time and data limitations, the analysis does not include all secondary benefits of reduced congestion, over and above the estimated reduction in travel delay itself. Severe bottlenecks and driving under highly congested conditions, which characterize several of the ramp and ramp approach roadways of the interchange, generally introduce significant unreliability into travel decision making, often necessitating drivers build in added buffer time to their trips.

No significant changes in VMT are anticipated as a result of The Project; accordingly, there are no changes in vehicle operating and maintenance costs measured for BCA purposes.

4. BCA Results

Based on the assumptions, methodology, and other information presented above, the project yields a Benefit Cost Ratio of 1.22 and a Net Present Value of \$30.8 million. The results are summarized in **Table 9**. Crash reductions comprise 60 percent of the total monetized benefits, followed by travel delay savings representing 33 percent, emissions at 4.6 percent, and shipper cost savings at 3 percent of total benefits. Additionally, two categories of freight benefits were measured: shipper and supply chain cost savings and truck travel time reductions. The present value of the two freight categories are \$18 million, or 10.7 percent of total project benefits.

Table 9. BCA Results

<u>Benefit Cost</u>	<u>Amount</u>
Discounted Initial Capital Costs	\$148.4
Discounted Life Cycle Cost Savings	-\$11.3
Facilities Residual Value	\$0.0
Total Discounted Costs	\$137.1
Crash Reductions Benefits	\$100.0
Travel Delay Cost Savings	\$55.1
Emissions Reduction Benefits (CO2 at a 3% discount rate)	\$5.1
Emissions Reduction Benefits (all others at a 7% discount rate)	\$2.6
Shipper/Supply Chain Cost Savings	\$5.1
Total Discounted Benefits	\$168.0
Benefit Cost Ratio	1.22
Net Present Value (\$M)	\$30.8

Source: EBP

[illegible]

Travel Time Delay Benefits		2025		2026		2027		2028		2029		2030		2031		2032		2033		2034		2035		2036		2037		2038		2039		2040		2041		2042		2043		2044		2045		2046		2047		2048		2049		2050		2051																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Hours of Delay Benefit		2025		2026		2027		2028		2029		2030		2031		2032		2033		2034		2035		2036		2037		2038		2039		2040		2041		2042		2043		2044		2045		2046		2047		2048		2049		2050		2051																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Passengers		301,021	305,277	309,542	313,810	318,076	322,342	326,608	331,479	336,048	340,616	345,183	350,077	354,969	359,862	364,754	369,646	374,538	379,429	384,321	389,212	394,104	399,046	403,987	408,929	413,871	418,813	423,755	428,697	433,639	438,581	443,523	448,465	453,407	458,349	463,291	468,233	473,175	478,117	483,059	488,001	492,943	497,885	502,827	507,769	512,711	517,653	522,595	527,537	532,479	537,421	542,363	547,305	552,247	557,189	562,131	567,073	572,015	576,957	581,899	586,841	591,783	596,725	601,667	606,609	611,551	616,493	621,435	626,377	631,319	636,261	641,203	646,145	651,087	656,029	660,971	665,913	670,855	675,797	680,739	685,681	690,623	695,565	700,507	705,449	710,391	715,333	720,275	725,217	730,159	735,101	740,043	744,985	749,927	754,869	759,811	764,753	769,695	774,637	779,579	784,521	789,463	794,405	799,347	804,289	809,231	814,173	819,115	824,057	828,999	833,941	838,883	843,825	848,767	853,709	858,651	863,593	868,535	873,477	878,419	883,361	888,303	893,245	898,187	903,129	908,071	913,013	917,955	922,897	927,839	932,781	937,723	942,665	947,607	952,549	957,491	962,433	967,375	972,317	977,259	982,201	987,143	992,085	997,027	1,001,969	1,006,911	1,011,853	1,016,795	1,021,737	1,026,679	1,031,621	1,036,563	1,041,505	1,046,447	1,051,389	1,056,331	1,061,273	1,066,215	1,071,157	1,076,099	1,081,041	1,085,983	1,090,925	1,095,867	1,100,809	1,105,751	1,110,693	1,115,635	1,120,577	1,125,519	1,130,461	1,135,403	1,140,345	1,145,287	1,150,229	1,155,171	1,160,113	1,165,055	1,169,997	1,174,939	1,179,881	1,184,823	1,189,765	1,194,707	1,199,649	1,204,591	1,209,533	1,214,475	1,219,417	1,224,359	1,229,301	1,234,243	1,239,185	1,244,127	1,249,069	1,254,011	1,258,953	1,263,895	1,268,837	1,273,779	1,278,721	1,283,663	1,288,605	1,293,547	1,298,489	1,303,431	1,308,373	1,313,315	1,318,257	1,323,199	1,328,141	1,333,083	1,338,025	1,342,967	1,347,909	1,352,851	1,357,793	1,362,735	1,367,677	1,372,619	1,377,561	1,382,503	1,387,445	1,392,387	1,397,329	1,402,271	1,407,213	1,412,155	1,417,097	1,422,039	1,426,981	1,431,923	1,436,865	1,441,807	1,446,749	1,451,691	1,456,633	1,461,575	1,466,517	1,471,459	1,476,401	1,481,343	1,486,285	1,491,227	1,496,169	1,501,111	1,506,053	1,510,995	1,515,937	1,520,879	1,525,821	1,530,763	1,535,705	1,540,647	1,545,589	1,550,531	1,555,473	1,560,415	1,565,357	1,570,299	1,575,241	1,580,183	1,585,125	1,590,067	1,595,009	1,599,951	1,604,893	1,609,835	1,614,777	1,619,719	1,624,661	1,629,603	1,634,545	1,639,487	1,644,429	1,649,371	1,654,313	1,659,255	1,664,197	1,669,139	1,674,081	1,679,023	1,683,965	1,688,907	1,693,849	1,698,791	1,703,733	1,708,675	1,713,617	1,718,559	1,723,501	1,728,443	1,733,385	1,738,327	1,743,269	1,748,211	1,753,153	1,758,095	1,763,037	1,767,979	1,772,921	1,777,863	1,782,805	1,787,747	1,792,689	1,797,631	1,802,573	1,807,515	1,812,457	1,817,399	1,822,341	1,827,283	1,832,225	1,837,167	1,842,109	1,847,051	1,851,993	1,856,935	1,861,877	1,866,819	1,871,761	1,876,703	1,881,645	1,886,587	1,891,529	1,896,471	1,901,413	1,906,355	1,911,297	1,916,239	1,921,181	1,926,123	1,931,065	1,936,007	1,940,949	1,945,891	1,950,833	1,955,775	1,960,717	1,965,659	1,970,601	1,975,543	1,980,485	1,985,427	1,990,369	1,995,311	2,000,253	2,005,195	2,010,137	2,015,079	2,020,021	2,024,963	2,029,905	2,034,847	2,039,789	2,044,731	2,049,673	2,054,615	2,059,557	2,064,499	2,069,441	2,074,383	2,079,325	2,084,267	2,089,209	2,094,151	2,099,093	2,104,035	2,108,977	2,113,919	2,118,861	2,123,803	2,128,745	2,133,687	2,138,629	2,143,571	2,148,513	2,153,455	2,158,397	2,163,339	2,168,281	2,173,223	2,178,165	2,183,107	2,188,049	2,192,991	2,197,933	2,202,875	2,207,817	2,212,759	2,217,701	2,222,643	2,227,585	2,232,527	2,237,469	2,242,411	2,247,353	2,252,295	2,257,237	2,262,179	2,267,121	2,272,063	2,277,005	2,281,947	2,286,889	2,291,831	2,296,773	2,301,715	2,306,657	2,311,599	2,316,541	2,321,483	2,326,425	2,331,367	2,336,309	2,341,251	2,346,193	2,351,135	2,356,077	2,361,019	2,365,961	2,370,903	2,375,845	2,380,787	2,385,729	2,390,671	2,395,613	2,400,555	2,405,497	2,410,439	2,415,381	2,420,323	2,425,265	2,430,207	2,435,149	2,440,091	2,445,033	2,449,975	2,454,917	2,459,859	2,464,801	2,469,743	2,474,685	2,479,627	2,484,569	2,489,511	2,494,453	2,499,395	2,504,337	2,509,279	2,514,221	2,519,163	2,524,105	2,529,047	2,533,989	2,538,931	2,543,873	2,548,815	2,553,757	2,558,699	2,563,641	2,568,583	2,573,525	2,578,467	2,583,409	2,588,351	2,593,293	2,598,235	2,603,177	2,608,119	2,613,061	2,618,003	2,622,945	2,627,887	2,632,829	2,637,771	2,642,713	2,647,655	2,652,597	2,657,539	2,662,481	2,667,423	2,672,365	2,677,307	2,682,249	2,687,191	2,692,133	2,697,075	2,702,017	2,706,959	2,711,901	2,716,843	2,721,785	2,726,727	2,731,669	2,736,611	2,741,553	2,746,495	2,751,437	2,756,379	2,761,321	2,766,263	2,771,205	2,776,147	2,781,089	2,786,031	2,790,973	2,795,915	2,800,857	2,805,799	2,810,741	2,815,683	2,820,625	2,825,567	2,830,509	2,835,451	2,840,393	2,845,335	2,850,277	2,855,219	2,860,161	2,865,103	2,870,045	2,874,987	2,879,929	2,884,871	2,889,813	2,894,755	2,899,697	2,904,639	2,909,581	2,914,523	2,919,465	2,924,407	2,929,349	2,934,291	2,939,233	2,944,175	2,949,117	2,954,059	2,958,999	2,963,941	2,968,883	2,973,825	2,978,767	2,983,709	2,988,651	2,993,593	2,998,535	3,003,477	3,008,419	3,013,361	3,018,303	3,023,245	3,028,187	3,033,129	3,038,071	3,043,013	3,047,955	3,052,897	3,057,839	3,062,781	3,067,723	3,072,665	3,077,607	3,082,549	3,087,491	3,092,433	3,097,375	3,102,317	3,107,259	3,112,201	3,117,143	3,122,085	3,127,027	3,131,969	3,136,911	3,141,853	3,146,795	3,151,737	3,156,679	3,161,621	3,166,563	3,171,505	3,176,447	3,181,389	3,186,331	3,191,273	3,196,215	3,201,157	3,206,099	3,211,041	3,215,983	3,220,925	3,225,867	3,230,809	3,235,751	3,240,693	3,245,635	3,250,577	3,255,519	3,260,461	3,265,403	3,270,345	3,275,287	3,280,229	3,285,171	3,290,113	3,295,055	3,299,997	3,304,939	3,309,881	3,314,823	3,319,765	3,324,707	3,329,649	3,334,591	3,339,533	3,344,475	3,349,417	3,354,359	3,359,301	3,364,243	3,369,185	3,374,127	3,379,069	3,384,011	3,388,953	3,393,895	3,398,837	3,403,779	3,408,721	3,413,663	3,418,605	3,423,547	3,428,489	3,433,431	3,438,373	3,443,315	3,448,257	3,453,199	3,458,141	3,463,083	3,468,025	3,472,967	3,477,909	3,482,851	3,487,793	3,492,735	3,497,677	3,502,619	3,507,561	3,512,503	3,517,445	3,522,387	3,527,329	3,532,271	3,537,213	3,542,155	3,547,097	3,552,039	3,556,981	3,561,923	3,566,865	3,571,807	3,576,749	3,581,691	3,586,633	3,591,575	3,596,517	3,601,459	3,606,401	3,611,343	3,616,285	3,621,227	3,626,169	3,631,111	3,636,053	3,640,995	3,645,937	3,650,879	3,655,821	3,660,763	3,665,705	3,670,647	3,675,589	3,680,531	3,685,473	3,690,415	3,695,357	3,700,299	3,705,241	3,710,183	3,715,125	3,720,067	3,725,009	3,729,951	3,734,893	3,739,835	3,744,777	3,749,719	3,754,661	3,759,603	3,764,545	3,769,487	3,774,429	3,779,371	3,784,313	3,789,255	3,794,197	3,799,139	3,804,081	3,809,023	3,813,965	3,818,907	3,823,849	3,828,791	3,833,733	3,838,675	3,843,617	3,848,559	3,853,501	3,858,443	3,863,385	3,868,327	3,873,269	3,878,211	3,883,153	3,888,095	3,893,037	3,897,979	3,902,921	3,907,863	3,912,805	3,917,747	3,922,689	3,927,631	3,932,573	3,937,515	3,942,457	3,947,399	3,952,341	3,957,283	3,962,225	3,967,167	3,972,109	3,977,051	3,981,993	3,986,935	3,991,877	3,996,819	4,001,761	4,006,703	4,011,645	4,016,587	4,021,529	4,026,471	4,031,413	4,036,355	4,041,297	4,046,239	4,051,181	4,056,123	4,061,065	4,066,007	4,070,949	4,075,891	4,080,833	4,085,775	4,090,717	4,095,659	4,100,601	4,105,543	4,110,485	4,115,427	4,120,369	4,125,311	4,130,253	4,135,195	4,140,137	4,145,079	4,150,021	4,154,963	4,159,905	4,164,847	4,169,789	4,174,731	4,179,673	4,184,615	4,189,557	4,194,499	4,199,441	4,204,383	4,209,325	4,214,267	4,219,209	4,224,151	4,229,093	4,234,035	4,238,977	4,243,919	4,248,861	4,253,803	4,258,745	4,263,687	4,268,629	4,273,571	4,278,513	4,283,455	4,288,397	4,293,339	4,298,281	4,303,223	4,308,165	4,313,107	4,318,049	4,322,991	4,327,933	4,332,875	4,337,817	4,342,759	4,347,701	4,352,643	4,357,585	4,362,527	4,367,469	4,372,411	4,377,353	4,382,295	4,387,237	4,392,179	4,397,121	4,402,063	4,407,005	4,411,947	4,416,889	4,421,831	4,426,773	4,431,715	4,436,657	4,441,599	4,446,541	4,451,483	4,456,425	4,461,367	4,466,309	4,471,251	4,476,193	4,481,135	4,486,077	4,491,019	4,495,961	4,500,903	4,505,845	4,510,787	4,515,729	4,52

[illegible]

[illegible]

[illegible]

This duplicate of a previously funded application is intended for reference only.

Fixed Factors

Source: USDOT ECA Guidance (2022)

Vehicle Level	Recommended Value (2020)
G. No Injury	\$5,700
C. Possible Injury	\$77,200
B. More Inconvenient	\$151,000
A. Inconvenient	\$254,800
E. Value	\$11,600,000
H. Injured (Severity Unknown)	\$200,000
# Accidents Reported (Unknown if Injured)	\$559,800

Vehicle Operating Costs (Including Fuel Costs)	Value / Mile (2020)
Light Duty Vehicles	\$0.45
Combination Trucks	\$0.34
Medium Duty Trucks	\$0.57

Average Vehicle Occupancy Rates for Highway Passenger Vehicles	
Vehicle Type	Average Occupancy
Passenger Vehicles (Highway, Peak)	1.48
Passenger Vehicles (Highway, Off-Peak)	1.58
Passenger Vehicles (Urban, Peak)	2.02
Passenger Vehicles (All Travel)	1.67
All Trucks	1.00

Value of Travel Time Savings	
Recommended Hourly Values of Travel Time Savings (2020 US \$ per Person-Hour)	
Category	Hourly Value
Personal Travel	
Personal	\$16.30
Business	\$29.40
All Purposes	\$17.80
Commercial Vehicle Operators	
Truck Drivers	\$32.00
Bus Drivers	\$33.60
Truck/Rail Operators	\$50.70
Locomotive Engineers	\$52.30

Improvement Type	Recommended Value per Person-Mile (Worked 2020 \$)
Facility Type	
Cycling Path with At-Gr	\$1.42
Cycling Path with At-Gr	\$1.78
Dedicated Cycling Lane	\$1.89
Cycling Boulevard/Shar	\$0.24
Separated Cycle Track	\$1.39
Improvement Type	Recommended Value per Person-Mile (Worked 2020 \$)
Exposed Sidewalk (per foot of added width)	\$0.10
Improvement Type	Recommended Value per Person-Mile (Worked 2020 \$)
Install Marked Crosswalk on Roadway with Volume >10,000 Vehicles per Day	\$0.18
Install Signal for Pedestrian Crossing on Roadway with Volume >10,000 Vehicles per Day	\$0.46
Base year of Normal Year	Multiplier to Adj to Real 2020
2003	1.38
2004	1.34
2005	1.3
2006	1.26
2007	1.23
2008	1.2
2009	1.2
2010	1.18
2011	1.16
2012	1.14
2013	1.12
2014	1.1
2015	1.09
2016	1.07
2017	1.05
2018	1.03
2019	1.01
2020	1

Bureau of Economic Analysis, National Income and Product Accounts, Table L.1.3, "Implicit Price Deflators for Gross Domestic Product" (October 2022)

Mode	VOG	NO	SO	PM	Cost
Passenger Car	4,200	7.75	1,004	0.309	12,393
Light/Medium Truck	8,009	61,334	0.34	2,987	40,964,2188
Heavy Truck	19,881	341,779	0.076	7,100	76,347
Bus & RT	11,802	363,437	0.476	4,460	
Passenger Rail and Transit Rail - Diesel	131.5	2729	1,906	66.13	
Passenger Rail and Transit Rail - Electric	0	0	0	0	
Rail Freight	1699	17108	22.75	661.7	
Water	0	0	0	0	
Aircraft	0	0	0	0	

For passenger cars and light trucks, medium-duty trucks, heavy-duty trucks, and buses the TRECDS team performed an analysis of the years 2003-2020 using MOVES as the national-level. Emissions rates were aggregated for each year, and the final rates took the average of the five evaluation years. MOVES default mode-year distributions were used for each evaluation year, and default (urban/interstate/uncongested) activity distributions were used. Running, starting, and extended idling (including overnight) emissions processes were all included and aggregated. Personal start and extended idling emissions were included in these aggregations, though in practice they would depend on the number of trips and congestion in aggregate regional analyses presented over time. This assumption is not inappropriate.

Rail (Electric) are based on factors used by the Surface Transportation Board's Section on Environmental Analysis' in a 2008 draft environmental impact statement concerning CN's proposal to acquire control of BNSF West Company.

Rail (Freight & Electric) are represented with emissions due to the inappropriateness of making assumptions on emissions from the electrical generation process which vary based on fuel mix and geography in ways that TRECDS cannot represent. If useful information is available, these factors should be updated.

Marine vehicles are based on ICF International, 2008. Current Methodologies in Preparing Mobile Source From-Related Emission Inventories, prepared for the US EPA Office of Policy, Economics, and Innovation, Sector Strategies Program, April 2008.

Air modes have default emissions of zero since the 4 criteria air pollutants are most damaging at local levels other than when emitted at altitude.

Emissions factors are based on per hour emission rates produced using the same methodology as emissions rates that are mileage-based. Marine engine data is available as emissions per hour and scaled to mileage-based rates.

Source: TRECDS Data Sources and Default Values (2022), US EPA Motor Vehicle Emission Simulator (MOVES3) (2022)

Emissions (g) per VMT						
Vehicle	PM 2.5	SO2	NO2	NOx	CO2	
Passenger Car	0.0008	0.0022	0.223	0.2175	400.07	
Light/Medium Truck	0.0341	0.0035	0.2093	1.0082	1,296.42	
Heavy Truck	0.0839	0.0055	0.1825	2.9024	1,470.32	

Emissions (Metric Tons) per VMT						
Mode	PM 2.5	SO2	NO2	NOx	CO2	
Passenger Car	4.41E-09	2.23E-09	2.23E-07	2.21E-07	4.00E-04	
Light/Medium Truck	1.41E-08	1.50E-09	2.66E-07	1.07E-06	1.36E-03	
Heavy Truck	8.10E-08	1.50E-09	1.80E-07	3.90E-06	1.48E-03	

Grains to Metric Tons Conversion Rate 1.00E-06

CO2 Per Gallon of Fuel Burned:	
19.2	Btu per gallon of gasoline
453,592	g per lb
8,090.4	g per gallon
22.4	Btu per gallon of diesel
453,592	g per lb
10,160.5	g per gallon of diesel

Fuel Burn Per Mile

Mode	Fuel per Mile
Passenger Car	0.0495 Gasoline
All Trucks	0.1521 Diesel
Tractor-Trailer	0.2253 Diesel
Light/Medium Duty	0.1379 Diesel

Emissions Values by Year, 2009 Dollars per Metric Ton

Year	PM2.5	SO2	NO2	NOx	CO2
2021	\$748,600	\$41,500	\$2,384	\$10,800	\$52
2022	\$743,600	\$42,300	\$2,384	\$10,800	\$53
2023	\$739,700	\$43,100	\$2,384	\$10,800	\$54
2024	\$736,100	\$44,000	\$2,384	\$10,800	\$55
2025	\$687,700	\$44,900	\$2,384	\$10,800	\$56
2026	\$683,500	\$45,700	\$2,384	\$10,800	\$57
2027	\$677,600	\$46,500	\$2,384	\$10,800	\$58
2028	\$669,600	\$47,300	\$2,384	\$10,800	\$59
2029	\$664,600	\$48,200	\$2,384	\$10,800	\$60
2030	\$667,600	\$49,100	\$2,384	\$10,800	\$61
2031	\$667,600	\$49,100	\$2,384	\$10,800	\$62
2032	\$667,600	\$49,100	\$2,384	\$10,800	\$63
2033	\$667,600	\$49,100	\$2,384	\$10,800	\$64
2034	\$667,600	\$49,100	\$2,384	\$10,800	\$65
2035	\$667,600	\$49,100	\$2,384	\$10,800	\$66
2036	\$667,600	\$49,100	\$2,384	\$10,800	\$67
2037	\$667,600	\$49,100	\$2,384	\$10,800	\$68
2038	\$667,600	\$49,100	\$2,384	\$10,800	\$69
2039	\$667,600	\$49,100	\$2,384	\$10,800	\$70
2040	\$667,600	\$49,100	\$2,384	\$10,800	\$71
2041	\$667,600	\$49,100	\$2,384	\$10,800	\$72
2042	\$667,600	\$49,100	\$2,384	\$10,800	\$73
2043	\$667,600	\$49,100	\$2,384	\$10,800	\$74
2044	\$667,600	\$49,100	\$2,384	\$10,800	\$75
2045	\$667,600	\$49,100	\$2,384	\$10,800	\$76
2046	\$667,600	\$49,100	\$2,384	\$10,800	\$77
2047	\$667,600	\$49,100	\$2,384	\$10,800	\$78
2048	\$667,600	\$49,100	\$2,384	\$10,800	\$79
2049	\$667,600	\$49,100	\$2,384	\$10,800	\$80
2050	\$667,600	\$49,100	\$2,384	\$10,800	\$81
2051	\$667,600	\$49,100	\$2,384	\$10,800	\$82
2052	\$667,600	\$49,100	\$2,384	\$10,800	\$83
2053	\$667,600	\$49,100	\$2,384	\$10,800	\$84
2054	\$667,600	\$49,100	\$2,384	\$10,800	\$85
2055	\$667,600	\$49,100	\$2,384	\$10,800	\$86
2056	\$667,600	\$49,100	\$2,384	\$10,800	\$87
2057	\$667,600	\$49,100	\$2,384	\$10,800	\$88
2058	\$667,600	\$49,100	\$2,384	\$10,800	\$89
2059	\$667,600	\$49,100	\$2,384	\$10,800	\$90
2060	\$667,600	\$49,100	\$2,384	\$10,800	\$91

Source: Benefits Cost Analysis Guidance for Discretionary Grant Programs, Table A-6. Damage Costs for Emissions per Metric Ton, March 2022 Revised & TRECDS Technical Documentation: Data Sources and Default Values Appendix B

Emissions decrease adjustment factor over time to account for vehicle fleet transition

Year	PM2.5	SO2	NO2	NOx	CO2
2021	1.00	1.00	1.00	1.00	1.00
2022	0.89	0.96	0.94	0.93	0.98
2023	0.80	0.96	0.88	0.87	0.96
2024	0.71	0.94	0.82	0.81	0.95
2025	0.63	0.92	0.77	0.75	0.93
2026	0.56	0.91	0.72	0.70	0.91
2027	0.50	0.89	0.67	0.65	0.89
2028	0.45	0.87	0.63	0.61	0.88
2029	0.40	0.85	0.59	0.56	0.86
2030	0.36	0.84	0.55	0.52	0.84
2031	0.32	0.82	0.52	0.49	0.83
2032	0.28	0.81	0.49	0.45	0.81
2033	0.25	0.79	0.45	0.42	0.80
2034	0.23	0.77	0.43	0.39	0.78
2035	0.20	0.76	0.40	0.37	0.77
2036	0.18	0.75	0.37	0.34	0.76
2037	0.16	0.73	0.35	0.32	0.74
2038	0.14	0.72	0.33	0.30	0.73
2039	0.13	0.70	0.31	0.28	0.71
2040	0.11	0.69	0.29	0.26	0.70
2041	0.10	0.68	0.27	0.24	0.69
2042	0.09	0.66	0.25	0.22	0.67
2043	0.08	0.65	0.24	0.21	0.66
2044	0.07	0.64	0.22	0.19	0.65
2045	0.06	0.62	0.21	0.18	0.64
2046	0.06	0.61	0.19	0.17	0.63
2047	0.05	0.60	0.18	0.16	0.61
2048	0.05	0.59	0.17	0.14	0.60
2049	0.04	0.58	0.15	0.13	0.59
2050	0.04	0.57	0.15	0.13	0.58
2051	0.03	0.56	0.14	0.12	0.57
2052	0.03	0.54	0.13	0.11	0.56
2053	0.03	0.53	0.12	0.10	0.55
2054	0.02	0.52	0.11	0.09	0.54
2055	0.02	0.51	0.11	0.09	0.53
2056	0.02	0.50	0.10	0.08	0.52
2057	0.02	0.49	0.09	0.08	0.51
2058	0.01	0.48	0.09	0.07	0.50
2059	0.01	0.47	0.08	0.07	0.49
2060	0.01	0.47	0.08	0.06	0.48

Emission Rate Change (2022-2020)

Substance	Average Annual % Emissions Reduction
CO2	1.00%
NOx	6.38%
PM2.5	10.83%
SO2	1.84%
NO2	8.92%

Source: Calculated using TRECDS Data Sources and Default Values (2022), US EPA Motor Vehicle Emission Simulator (MOVES3) (2022)

Turn on Fleet efficiency

[illegible]

SCTG2	SCTG Descr	2025	2030	2035	2040	2045	2050
1	Live animal	\$2,938	\$3,146	\$3,369	\$3,608	\$3,863	\$4,133
2	Cereal grain	\$9,333	\$9,994	\$10,702	\$11,461	\$12,273	\$13,130
3	Other ag pr	\$2,516	\$2,694	\$2,885	\$3,090	\$3,309	\$3,540
4	Animal feed	\$2,881	\$3,085	\$3,304	\$3,538	\$3,788	\$4,053
5	Meat/seafo	\$3,258	\$3,489	\$3,736	\$4,001	\$4,284	\$4,583
6	Milled grain	\$4,618	\$4,945	\$5,296	\$5,671	\$6,073	\$6,497
7	Other food	\$20,202	\$21,633	\$23,166	\$24,808	\$26,566	\$28,422
8	Alcoholic b	\$2,588	\$2,772	\$2,968	\$3,179	\$3,404	\$3,642
9	Tobacco pr	\$27	\$29	\$31	\$33	\$36	\$38
10	Building sto	\$60	\$64	\$69	\$74	\$79	\$84
11	Natural san	\$300	\$322	\$344	\$369	\$395	\$423
12	Gravel	\$391	\$419	\$449	\$480	\$515	\$550
13	Nonmetalli	\$2,929	\$3,137	\$3,359	\$3,597	\$3,852	\$4,121
14	Metallic ore	\$766	\$820	\$878	\$941	\$1,007	\$1,078
15	Coal	\$20	\$22	\$23	\$25	\$26	\$28
16	Crude petro	\$158	\$169	\$181	\$194	\$208	\$222
17	Gasoline	\$10,126	\$10,844	\$11,612	\$12,435	\$13,317	\$14,247
18	Fuel oils	\$5,374	\$5,754	\$6,162	\$6,599	\$7,066	\$7,560
19	Coal-n.e.c.	\$208,345	\$223,109	\$238,919	\$255,850	\$273,981	\$293,126
20	Basic chem	\$6,996	\$7,491	\$8,022	\$8,591	\$9,199	\$9,842
21	Pharmaceu	\$849	\$910	\$974	\$1,043	\$1,117	\$1,195
22	Fertilizers	\$24,909	\$26,674	\$28,564	\$30,588	\$32,756	\$35,045
23	Chemical p	\$5,635	\$6,034	\$6,462	\$6,920	\$7,410	\$7,928
24	Plastics/rub	\$10,753	\$11,515	\$12,331	\$13,205	\$14,141	\$15,129
25	Logs	\$139	\$149	\$159	\$171	\$183	\$196
26	Wood prod	\$8,842	\$9,469	\$10,140	\$10,858	\$11,628	\$12,440
27	Newsprint/	\$2,725	\$2,919	\$3,125	\$3,347	\$3,584	\$3,835
28	Paper artic	\$14,654	\$15,692	\$16,804	\$17,995	\$19,270	\$20,617
29	Printed pro	\$2,256	\$2,416	\$2,587	\$2,771	\$2,967	\$3,174
30	Textiles/lea	\$2,130	\$2,281	\$2,442	\$2,615	\$2,801	\$2,996
31	Nonmetal r	\$27,590	\$29,545	\$31,639	\$33,881	\$36,282	\$38,817
32	Baseline m	\$36,646	\$39,243	\$42,024	\$45,002	\$48,191	\$51,559
33	Articles-Bas	\$21,977	\$23,534	\$25,202	\$26,988	\$28,900	\$30,919
34	Machinery	\$44,806	\$47,982	\$51,382	\$55,023	\$58,922	\$63,039
35	Electronics	\$23,938	\$25,635	\$27,451	\$29,397	\$31,480	\$33,680
36	Motorized	\$21,360	\$22,873	\$24,494	\$26,230	\$28,089	\$30,052
37	Transport e	\$1,368	\$1,465	\$1,568	\$1,680	\$1,799	\$1,924
38	Precision in	\$1,387	\$1,485	\$1,590	\$1,703	\$1,824	\$1,951
39	Furniture	\$4,735	\$5,070	\$5,429	\$5,814	\$6,226	\$6,661
40	Misc. mfg.	\$14,064	\$15,061	\$16,128	\$17,271	\$18,495	\$19,788
41	Waste/scra	\$2,131	\$2,282	\$2,444	\$2,617	\$2,802	\$2,998
43	Mixed freig	\$11,675	\$12,503	\$13,389	\$14,337	\$15,353	\$16,426
99	Unknown	\$0	\$0	\$0	\$0	\$0	\$0
Total		\$568,395	\$608,674	\$651,808	\$697,998	\$747,461	\$799,690

ENHANCING SAFETY AND MOBILITY IN WEST TULSA: I-44 AND US-75 CORRIDOR IMPROVEMENTS

Appendix Report: Project Benefit Cost Analysis

Oklahoma Department of Transportation

MAY 2022

Report Prepared by:
EBP US, Inc.

In Association with:
High Street Consulting Group, LLC (Prime Contractor)
Boe & Associates, Inc.

This duplicate of a previously funded application is intended for reference only.

Contents

- 1. Overview of Approach.....1
- 2. Project Costs1
 - 2.1. Capital Cost2
 - 2.2. Operations and Maintenance Costs2
- 3. Project Benefits.....2
 - 3.1. Monetized Benefits included in the BCA2
 - 3.2. Project Benefits Not Included in the BCA..... 10
- 4. BCA Results10

1. Overview of Approach

A Benefit Cost Analysis (BCA) was conducted for work phases (WP) 2, 3, and 5 of the I-44/US-75 Interchange, a major part of the overall “Enhancing Safety and Mobility in West Tulsa: I-44 and US-75 Corridor Improvements” project (The Project). The BCA follows the most recent 2022 USDOT guidance for BCAs, which provides both methodological guidance and specific values for monetizing various types of benefits, such as hourly values of travel time, and the economic cost of vehicle crashes (including pedestrian-vehicle incidents), and air emissions. All values from that guidance are in 2020 dollars. All monetary values in the BCA, including costs, are expressed in constant 2020 dollars.

The following general parameters and assumptions have been used in conducting the BCA:

- A real discount rate of 7 percent is applied to all costs and benefits except for carbon emissions reductions, which are discounted at 3 percent.
- A project life cycle of 25 years is assumed, which represents a mid-point between a recommended 20-year horizon of analysis for rehab and replace projects, vs. 30 years for new right-of-way and facilities. The I-44 and US-75 Corridor Improvement Project comprises multiple individual elements reflecting a mix of old and rehabbed infrastructure.
- No residual value is assumed at the close of the 25 years of operation.
- Project construction is assumed to begin in 2024 and end in late 2026, with operation commencing in 2027. Some advanced right-of-way acquisition for interchange construction will occur in the years 2021 – 2024.
- All costs and benefits are in 2020 dollars.
- The year 2020 was used as the base year for discounting; that is, 2020 is considered year zero for discounting.

2. Project Costs

Major capital, maintenance, and bridge rehab and repair costs are summarized in **Table 1**. These exclude routine maintenance for items such as patching, snow or ice clearance, or other non-capital items.

Table 1: Build and No-Build Capital and Major Rehab Cost Summary in Millions of 2020\$

	No-build	Build
Total Maintenance	\$43.33	\$8.59
I-44/US-75 Maintenance & rehab	\$20.00	\$8.59
Bridge Rehab	\$22.83	
Bridge Damage Repair	\$0.51	
Capital Costs	n/a	\$207.9

Source: Oklahoma DOT design engineers

2.1. Capital Cost

The estimated capital cost of The Project is \$207.9 million in 2020 dollars (including contingency), and is broken down as follows:

- WP 2: \$75.85 million
- WP 3: \$60.80 million
- WP 5: \$71.21 million

2.2. Operations and Maintenance Costs

The Project will result in very little difference in lane mileage compared to the No-Build and as such, no incremental difference in routine lane-related maintenance costs has been assumed. However, as seen in the cost summary, there are significant differences in non-routine maintenance, bridge repair, and rehabilitation costs, and bridge damage costs. Under the No-Build, ODOT engineers estimate that \$43.33 million has been and will be spent for non-routine roadway and bridge maintenance, compared with \$8.6 million for the Build (i.e., with I-44 and US-75 Corridor Improvement Projects). Except for \$9.2 million already spent before today for the existing infrastructure, US-75, these represent significant future life cycle cost savings, which are included as cost offsets for BCA purposes. These prior 9.2 million expenditures are excluded from the BCA; however, if included, the benefit cost ratio is still above 1.0 and demonstrates ODOT's commitment to a state of good repair.

3. Project Benefits

3.1. Monetized Benefits included in the BCA

Four primary categories of benefit have been captured by the BCA: reduced motor vehicle crashes, travel delay savings, logistics (freight) cost savings, and emissions cost reductions. As noted above, life cycle and cost savings were moved to the denominator of the benefit cost ratio calculation, following USDOT BCA guidance. Furthermore, economic benefits such as enhanced productivity (over and above those embodied in travel time savings) are not included. However, the overall improvements in regional accessibility may generate additional productivity benefits, such as agglomeration benefits reflecting the improved ability of employers to access specialized labor.

Crash Reductions: Because much of The Project involves reconfiguring the complex network of US-75 and I-44 interchanges and approach lanes and roadways to the interchanges, a significant share of the anticipated benefits will be reduced vehicular collisions and improved pedestrian safety. To estimate these likely impacts, a detailed data list of all collisions that occurred

throughout the I-44 and US-75 Corridor Improvement Projects limits between the years 2014 and 2018, by severity, was collected. Levels of severity were measured on a scale of one to five, including fatal crashes, injury crashes of three degrees of severity, and property-damage-only crashes. These levels of severity are assumed to be roughly equivalent to KABCO scale measurements.

The following count of crashes over the five-year period (covering the full calendar years 2014 through 2018) was obtained from ODOT:

- 408 PDO (property damage only)
- 201 Injury Severity 2 (least severe)
- 134 Injury Severity 3
- 25 Injury Severity 4
- 5 Fatal (including 1 pedestrian fatality)

Table 2 summarizes the accident data, VMT data, and calculations leading to estimated accident reductions.

Table 2. Crash rate reduction calculations

Crash Reductions for Work Packages 2, 3, and 5								
Annual Crashes (2014-2018)		Total	Annual Average	Crashes/MVMT				
	PDO	408	81.6	1.10				
	Injury Severity 2	201	40.2	0.54				
	Injury Severity 3	134	26.8	0.36				
	Injury Severity 4	25	5.0	0.07				
	Fatal	5	1.0	0.01				
VMT	2016 Actual	2040 Projected						
	WP2	29,739,324	42,872,225					
	WP3	28,454,999	38,123,064					
	WP5	15,673,173	21,149,031					
	Total	73,867,496	102,144,319					
Assumed Crash Reduction Factor								
45%								
Projected Annual Crashes (No Build)		2016	2025	2030	2035	2040	2045	2050
	PDO	81.60	92.15	98.59	105.48	112.85	120.73	129.17
	Injury Severity 2	40.20	45.40	48.57	51.96	55.59	59.48	63.63
	Injury Severity 3	26.80	30.26	32.38	34.64	37.06	39.65	42.42
	Injury Severity 4	5.00	5.65	6.04	6.46	6.91	7.40	7.91
	Fatal	1.00	1.13	1.21	1.29	1.38	1.48	1.58
Projected Annual Crash Reduction (Build)		2016	2025	2030	2035	2040	2045	2050
	PDO	n/a	41.47	44.36	47.46	50.78	54.33	58.13
	Injury Severity 2	n/a	20.43	21.86	23.38	25.02	26.77	28.64
	Injury Severity 3	n/a	13.62	14.57	15.59	16.68	17.84	19.09
	Injury Severity 4	n/a	2.54	2.72	2.91	3.11	3.33	3.56
	Fatal	n/a	0.51	0.54	0.58	0.62	0.67	0.71

Sources: Oklahoma DOT

Calculations: EBP

Based on these data, combined with annual vehicle miles traveled (VMT) measured across the project, crash rates were calculated (crashes per million VMT) and applied to ODOT's estimates of project-wide VMT in the future. A baseline of total anticipated crashes without the I-44 and US-75 Corridor Improvement Projects was then calculated for the entire project horizon of 25 years,

through the year 2050. Next, the FHWA's Crash Modification Factor (CMF) database was consulted to obtain the most applicable Crash Reduction Factor (CRF). This search yielded a most relevant CMF of 55 percent (and thus a CRF of 45 percent). The selected CMF/CRF is obtained from research involving the safety effects of replacing cloverleaf interchanges with directional lanes. The relevant CMF was then applied to the future stream of No-Build crashes (by category of severity) to obtain estimates of reduced annual crashes over the study period.

The Project will generate significant savings in the human costs of crashes. Over the 25 years, it is estimated that about 15 lives will be saved, and another 77 serious injury-crashes will be avoided.

Travel Delay Savings: ODOT provided an analysis of travel delay reductions based on the application of the VISSIM traffic simulation model to a future 2045 build year. The model simulated the effects of The Project on travel times. Based on estimates provided by ODOT, the BCA analysis assumes that 75 percent of the total travel delay reductions due to the entire I-44 and US-75 corridor improvements can be attributed to WPs 2, 3, and 5. Travel delay savings for years before 2045 were reduced based on the anticipated compound annual growth rates (CAGR) in VMT projected for the corridor of about 1.36 percent per year. For the years after 2045, the delay was correspondingly increased by the same CAGR. In 2030, approximately 933 hours of travel delay would be saved by The Project each workday, covering morning and evening peak periods combined. Travel delay savings increases to approximately 1,075 hours of delay per workday in 2045.

Table 3 presents the outputs of the VISSIM run.

Table 4 presents the computations to derive the annual travel delay for trucks (vehicle hours of delay) and passenger (passenger hours of delay). These savings were monetized utilizing the values of time prescribed in the 2022 USDOT BCA guidance.

Table 3. VISSIM travel delay outputs, Build and No-Build

AM Period	Delay (Seconds)			
	All	Auto	Single Axle Truck	Multi-Axle Truck
2045 AM - No Action	4,048,058	3,672,981	136,664	238,412
Ult Build AM 2045	2,458,430	2,295,220	75,521	87,690
PM Period	Delay (Seconds)			
	All	Auto	Single Axle Truck	Multi-Axle Truck
2045 PM - No Action	5,247,408	4,756,955	189,138	301,314
Ult Build PM 2045	1,108,531	999,481	43,956	65,094

Source: Garver Engineering and ODOT

Table 4. Travel delay calculations

Daily Vehicle Hours	2025	2030	2035	2040	2045	2050
Auto	814	871	933	999	1,070	1,145
Single Axle Truck	33	35	37	40	43	46
Multi-Axle Truck	61	66	70	75	81	86
Annual Vehicle Hours	2025	2030	2035	2040	2045	2050
Auto	203,386	217,799	233,233	249,761	267,460	286,149
Single Axle Truck	8,172	8,751	9,371	10,035	10,746	11,497
Multi-Axle Truck	15,325	16,411	17,574	18,820	20,153	21,561
Annual passenger hours saved	301,011	322,342	345,185	369,646	395,841	423,500

Source: EBP

Notes: Delay savings attributable to Work Packages 2,3, and 5 equal 75% of total project-wide VISSIM results. Delay savings for years other than 2045 based on CAGR for project VMT. Delay savings reduced for years prior to 2045 by compound growth factor of $(1 - \text{CAGR})$.

Air Emissions Reductions: No significant changes in VMT are anticipated as a result of The Project and therefore emissions savings were estimated based upon delay reductions for passenger cars and light trucks, medium-duty trucks, and heavy-duty trucks. The emissions factors were extracted from the TREDIS model, which were derived from a national-level analysis using the EPA's MOVES model. MOVES default model year distributions were used for each evaluation year, and default rural/urban restricted/unrestricted activity distributions were used. Running, starting, and extended idle (including crankcase) emissions processes were all included and aggregated. The emissions factors displayed in **Table 5** are scaled up by a factor of 10^6 for easier reading and are converted to the appropriate units in the accompanying benefit cost model.

The estimates in emissions reduction are based on per-ton valuations for the type of emissions as outlined in the 2022 US DOT BCA Guidance. Emissions include carbon dioxide (CO_2), nitrogen oxides (NO_x), sulfur oxide (SO_x), volatile organic compounds (VOC), and particulate matter (PM 2.5). The cost of carbon was discounted at 3% while all other emissions were discounted at 7%. VOCs were included as VOCs are a precursor to ozone which is recognized as having serious health impacts and monetized using prior USDOT valuation guidance and adjusted to 2020 dollars. If VOCs are removed, the benefit cost ratio remains at 1.2 as the aggregate impact of the VOC estimates are an undiscounted \$105,700 over the 25-year benefit period.

Based on air emission rates, combined with the travel delay reductions, annual emissions reductions were calculated and monetized. The Project will reduce CO_2 emissions by 5.023 tons a year through reduced congestion. (see **Table 6**).

Table 5. Air emissions rates per hour of travel delay in Tons multiplied by 10⁶.

	Co2	VOC	NOx	PM2.5	SOx
Car	12,884.90	4.96	7.79	0.37	0.08
Light Truck	40,664.22	6.83	64.33	2.99	0.34
Heavy Truck	76,946.75	19.88	241.78	7.17	0.68

Source: MOVES Emissions factors from TREDIS

Table 6. Aggregate Emissions Savings 2027-2051

	Total	Average Annual	Undiscounted \$
Co2	125,580.28	5,023.21	\$9,151,720
VOC	41.60	1.66	\$99,178
NOx	176.74	7.07	\$3,186,263
PM2.5	6.35	0.25	\$5,494,839
SOx	0.92	0.04	\$44,932
Total (excluding CO2)	n/a	n/a	\$8,825,212
Total (all emissions)			\$17,976,932

Source: EBP

Shipper and Logistics Cost Savings: Shipper and logistics cost savings are based on Freight Analysis Framework (FAF) Tulsa FAF region for 2020, truck travel delay savings, and data from the TREDIS-based Multimodal Benefit Cost Analysis (MBCA) tool. The FAF data were used to develop a commodity mix breakdown of the trucking data (see **Table 7**), and the commodity mixes were cross-referenced to Standard Classification of Transportation Goods (SCTG) data. These values are then applied to the truck travel delay savings to derive ton hours saved by commodity type and SCTG category. Ton hours saved are then multiplied by the hourly value of shipper delay for each commodity (hourly values are obtained from the TREDIS-based MBCA model). Costs are summed across all commodity types to derive the annual savings (see **Table 8**).

Table 7. Freight vehicle commodity mix breakout (Tulsa)

SCTG2	SCTG Description	Truck-Commodity Mix
1	Live animals/fish	0.3%
2	Cereal grains	2.7%
3	Other ag prods.	0.5%
4	Animal feed	0.6%
5	Meat/seafood	0.3%
6	Milled grain prods.	0.8%
7	Other foodstuffs	3.0%
8	Alcoholic beverages	0.3%
9	Tobacco prods.	0.0%
10	Building stone	0.0%
11	Natural sands	0.3%
12	Gravel	0.4%
13	Nonmetallic minerals	1.1%
14	Metallic ores	0.6%
15	Coal	0.0%
16	Crude petroleum	0.0%
17	Gasoline	2.2%
18	Fuel oils	1.4%
19	Coal-n.e.c.	50.0%
20	Basic chemicals	1.2%
21	Pharmaceuticals	0.0%
22	Fertilizers	7.8%
23	Chemical prods.	0.5%
24	Plastics/rubber	1.0%
25	Logs	0.0%
26	Wood prods.	1.4%
27	Newsprint/paper	0.3%
28	Paper articles	1.7%
29	Printed prods.	0.3%
30	Textiles/leather	0.2%
31	Nonmetal min. prods.	6.4%
32	Baseline metals	5.3%
33	Articles-Baseline metal	2.5%
34	Machinery	1.7%
35	Electronics	0.9%
36	Motorized vehicles	0.8%
37	Transport equip.	0.1%
38	Precision instruments	0.0%
39	Furniture	0.4%
40	Misc. mfg. prods.	0.8%
41	Waste/scrap	0.3%
43	Mixed freight	1.8%
99	Unknown	0.0%

Source: Tulsa FAF Region (2020)

Table 8. Calculation of shipper benefits for selected years

SCTG2	SCTG Description	2025	2030	2035	2040	2045	2050
1	Live animals/fish	\$2,938	\$3,146	\$3,369	\$3,608	\$3,863	\$4,133
2	Cereal grains	\$9,333	\$9,994	\$10,702	\$11,461	\$12,273	\$13,130
3	Other ag prods.	\$2,516	\$2,694	\$2,885	\$3,090	\$3,309	\$3,540
4	Animal feed	\$2,881	\$3,085	\$3,304	\$3,538	\$3,788	\$4,053
5	Meat/seafood	\$3,258	\$3,489	\$3,736	\$4,001	\$4,284	\$4,583
6	Milled grain prods.	\$4,618	\$4,945	\$5,296	\$5,671	\$6,073	\$6,497
7	Other foodstuffs	\$20,202	\$21,633	\$23,166	\$24,808	\$26,566	\$28,422
8	Alcoholic beverages	\$2,588	\$2,772	\$2,968	\$3,179	\$3,404	\$3,642
9	Tobacco prods.	\$27	\$29	\$31	\$33	\$36	\$38
10	Building stone	\$60	\$64	\$69	\$74	\$79	\$84
11	Natural sands	\$300	\$322	\$344	\$369	\$395	\$423
12	Gravel	\$391	\$419	\$449	\$480	\$515	\$550
13	Nonmetallic minerals	\$2,929	\$3,137	\$3,359	\$3,597	\$3,852	\$4,121
14	Metallic ores	\$766	\$820	\$878	\$941	\$1,007	\$1,078
15	Coal	\$20	\$22	\$23	\$25	\$26	\$28
16	Crude petroleum	\$158	\$169	\$181	\$194	\$208	\$222
17	Gasoline	\$10,126	\$10,844	\$11,612	\$12,435	\$13,317	\$14,247
18	Fuel oils	\$5,374	\$5,754	\$6,162	\$6,599	\$7,066	\$7,560
19	Coal-n.e.c.	\$208,345	\$223,109	\$238,919	\$255,850	\$273,981	\$293,126
20	Basic chemicals	\$6,996	\$7,491	\$8,022	\$8,591	\$9,199	\$9,842
21	Pharmaceuticals	\$849	\$910	\$974	\$1,043	\$1,117	\$1,195
22	Fertilizers	\$24,909	\$26,674	\$28,564	\$30,588	\$32,756	\$35,045
23	Chemical prods.	\$5,635	\$6,034	\$6,462	\$6,920	\$7,410	\$7,928
24	Plastics/rubber	\$10,753	\$11,515	\$12,331	\$13,205	\$14,141	\$15,129
25	Logs	\$139	\$149	\$159	\$171	\$183	\$196
26	Wood prods.	\$8,842	\$9,469	\$10,140	\$10,858	\$11,628	\$12,440
27	Newsprint/paper	\$2,725	\$2,919	\$3,125	\$3,347	\$3,584	\$3,835
28	Paper articles	\$14,654	\$15,692	\$16,804	\$17,995	\$19,270	\$20,617
29	Printed prods.	\$2,256	\$2,416	\$2,587	\$2,771	\$2,967	\$3,174
30	Textiles/leather	\$2,130	\$2,281	\$2,442	\$2,615	\$2,801	\$2,996
31	Nonmetal min. prods.	\$27,590	\$29,545	\$31,639	\$33,881	\$36,282	\$38,817
32	Baseline metals	\$36,646	\$39,243	\$42,024	\$45,002	\$48,191	\$51,559
33	Articles-Baseline metals	\$21,977	\$23,534	\$25,202	\$26,988	\$28,900	\$30,919
34	Machinery	\$44,806	\$47,982	\$51,382	\$55,023	\$58,922	\$63,039
35	Electronics	\$23,938	\$25,635	\$27,451	\$29,397	\$31,480	\$33,680
36	Motorized vehicles	\$21,360	\$22,873	\$24,494	\$26,230	\$28,089	\$30,052
37	Transport equip.	\$1,368	\$1,465	\$1,568	\$1,680	\$1,799	\$1,924
38	Precision instruments	\$1,387	\$1,485	\$1,590	\$1,703	\$1,824	\$1,951
39	Furniture	\$4,735	\$5,070	\$5,429	\$5,814	\$6,226	\$6,661
40	Misc. mfg. prods.	\$14,064	\$15,061	\$16,128	\$17,271	\$18,495	\$19,788
41	Waste/scrap	\$2,131	\$2,282	\$2,444	\$2,617	\$2,802	\$2,998
43	Mixed freight	\$11,675	\$12,503	\$13,389	\$14,337	\$15,353	\$16,426
99	Unknown	\$0	\$0	\$0	\$0	\$0	\$0
Total		\$568,395	\$608,674	\$651,808	\$697,998	\$747,461	\$799,690

This duplicate of a previously funded application is intended for reference only.

Source: EBP

3.2. Project Benefits Not Included in the BCA

Due to time and data limitations, the analysis does not include all secondary benefits of reduced congestion, over and above the estimated reduction in travel delay itself. Severe bottlenecks and driving under highly congested conditions, which characterize several of the ramp and ramp approach roadways of the interchange, generally introduce significant unreliability into travel decision making, often necessitating drivers build in added buffer time to their trips.

No significant changes in VMT are anticipated as a result of The Project; accordingly, there are no changes in vehicle operating and maintenance costs measured for BCA purposes.

4. BCA Results

Based on the assumptions, methodology, and other information presented above, the project yields a Benefit Cost Ratio of 1.22 and a Net Present Value of \$30.8 million. The results are summarized in **Table 9**. Crash reductions comprise 60 percent of the total monetized benefits, followed by travel delay savings representing 33 percent, emissions at 4.6 percent, and shipper cost savings at 3 percent of total benefits. Additionally, two categories of freight benefits were measured: shipper and supply chain cost savings and truck travel time reductions. The present value of the two freight categories are \$18 million, or 10.7 percent of total project benefits.

Table 9. BCA Results

<u>Benefit Cost</u>	<u>Amount</u>
Discounted Initial Capital Costs	\$148.4
Discounted Life Cycle Cost Savings	-\$11.3
Facilities Residual Value	\$0.0
Total Discounted Costs	\$137.1
Crash Reductions Benefits	\$100.0
Travel Delay Cost Savings	\$55.1
Emissions Reduction Benefits (CO2 at a 3% discount rate)	\$5.1
Emissions Reduction Benefits (all others at a 7% discount rate)	\$2.6
Shipper/Supply Chain Cost Savings	\$5.1
Total Discounted Benefits	\$168.0
Benefit Cost Ratio	1.22
Net Present Value (\$M)	\$30.8

Source: EBP